June 11, 1956 50 Cents

AVIATION WEEK

A McGRAW-HILL PUBLICATION

First Pictures of Piper Comanche

•

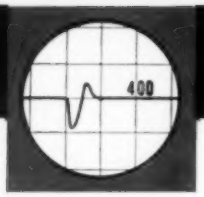
Auto-Navigator "Senses" Error

Convair F-102A Explores New Production Cycle

E R POWER GS
UNIVERSITY MICROFILM IN
313 N 1ST ST
ANN ARBOR MICH

First in Constant Speed Drives...

SUNDSTRAND



RB-66 advanced electrical system design made possible by Sundstrand Constant Speed Drives

The Air Force's RB-66, 600-700 mph photo-reconnaissance plane built by Douglas, incorporates the most advanced equipment yet devised for accurate reports on operations. To power the heavy electrical load, the RB-66 also incorporates advanced thinking in the electrical system design—a constant frequency Sundstrand-driven system that is automatic, paralleled, able to supply plenty of stable power under all flight conditions, and having heavy overload capacity. Necessary capacity is gained with less weight, easier utilization, assured reliability. The RB-66 proves again how advanced design in electrical systems . . . made possible by the Sundstrand Constant Speed Drive . . . meets the challenge of today's . . . and tomorrow's . . . fast, high-flying jets.

New Electrical Horizons . . .

are opening to design engineers, through co-operation between engine and airframe manufacturers and Sundstrand. With this advanced design in electrical systems, expect remarkable advances in operation and performance of tomorrow's aircraft.

SUNDSTRAND AVIATION

Division of Sundstrand Machine Tool Company, ROCKFORD, ILLINOIS Western District Office: Hawthorne, California

CONSTANT SPEED DRIVES · AIRCRAFT ACCESSORIES

Foremost **Network** on the Airways!

Across the length and breadth of this land of ours, one organizational network stands out as *first in service* to America's vast armada of private and corporate aircraft.

As a result, when the men who fly and own these planes need *any* part or srvice—they look for the operator who displays the Goodyear Aviation Products "Sign of Service."

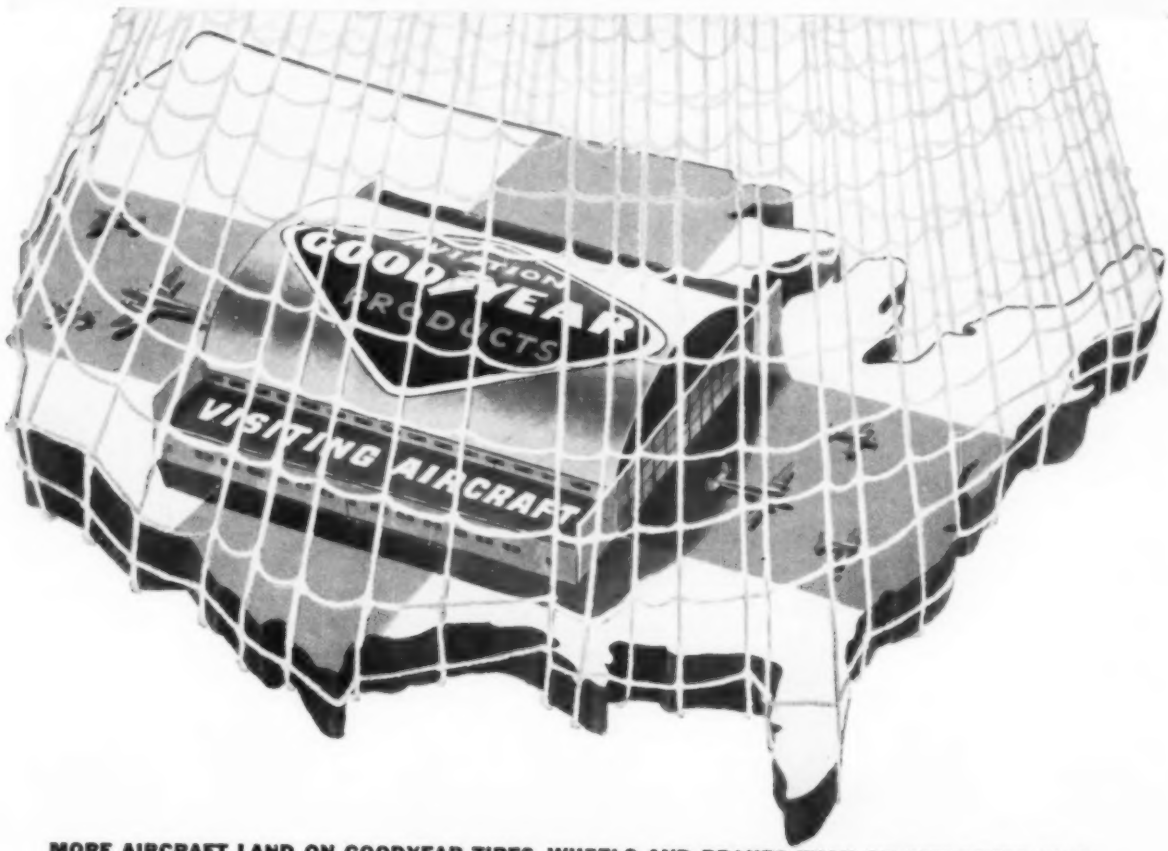
It's a sign which has earned an enviable reputation—thanks to the backing of a distributor organization and dealer group which has the complete confidence of private aviation.

The vast dealer network which displays the sign maintains a full stock of products chosen *by more aircraft manufacturers as original equipment than any other kind*—supplied by 42 distributors who are strategically located throughout the nation.

This dealer-distributor team has an unrivaled reputation for prompt service and ready availability of quality products. And for fair play. It's *the* network that has kept pace with the phenomenal growth of civil aviation—and served it well.

Be sure to look for the famous "Sign of Service," wherever you fly. *You won't have to look far!*

Goodyear, Aviation Products Division,
Akron 16, Ohio, and Los Angeles 54, California



MORE AIRCRAFT LAND ON GOODYEAR TIRES, WHEELS AND BRAKES THAN ON ANY OTHER KIND

Design, Development, Production

CASE HISTORIES

of Weber Aircraft Corporation

subject:

T-37 EJECTION SEATS

Weber Aircraft Corporation, 2820 Ontario Street, Burbank, California

CESSNA SELECTS WEBER EJECTION SEATS FOR SPLIT-SECOND SAFETY IN NEW TWIN-JET T-37 TRAINER

The new T-37 twin-jet trainer developed for the Air Force by the Cessna Aircraft Company of Wichita features two side-by-side Weber Ejection Seats to provide maximum safety and comfort of the flight instructor and cadet pilot.

Operates like combat-type aircraft

This new trainer incorporates all the latest equipment and design techniques of high performance jet aircraft. In addition to ejection-type seats and jettisonable canopy, the plane includes electric trim tabs and hydraulically actuated speed brakes.

Seating increases teaching efficiency

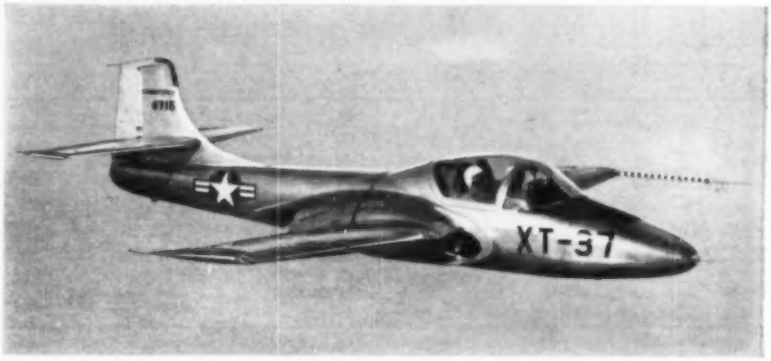
The T-37 is the first jet trainer to adopt side-by-side seating. It provides greater flexibility in training, as well as greater safety. The cadet gets the benefit of closer, more personal instruction, and the flight instructor is literally the cadet's right hand.

Cuts training time and costs

By introducing the cadet pilot to jet aircraft at an earlier phase of the training cycle, the T-37 reduces training time and costs. The side-by-side seating also allows for a smoother, safer transition than heretofore possible.

Seats undergo rigid testing

In developing ejection seats for high performance type aircraft, like the T-37, Weber carries out an exhaustive test program. Included in the test equipment maintained by Weber is an actual firing test stand where every prototype is given the full treatment. Extensive design, development and production facilities, have made Weber the leading producer of aircraft ejection seats. If you have any seating problems: pilot, crew, passenger or ejection, a Weber engineering team can solve it.



Cessna T-37, high performance, twin jet trainer

Weber ejection seats provide extra safety and comfort

Weber firing test stand checks out prototype

Also Manufacturers of:

Pilot and Crew Seats · Passenger Seats / Buffets · Wash Basins · Other Interior Equipment / Aerostands · Aeroramps / Airframe Sub-assemblies

WEBER AIRCRAFT CORPORATION, 2820 ONTARIO STREET, BURBANK, CALIFORNIA

AVIATION CALENDAR

June 13—B. F. Goodrich Technical Forum, co-sponsored by Atlantic Aviation Corp. and Airwork Corp. Atlantic Aviation Hangar, Teterboro Airport, Teterboro.

June 17—Second Annual Air Show, sponsored by Post 1920 Veterans of Foreign Wars and Burlington Flying Service, Inc., Municipal Airport, Burlington, N. C.

June 17-21—American Society of Mechanical Engineers, semi-annual meeting. Hotel Statler, Cleveland, Ohio.

June 17-30—Third Annual Material Handling Training Conference, Lake Placid, N. Y.

June 18-20—American Rocket Society semi-annual meeting. **June 18**—banquet, Hotel Statler, Cleveland.

June 18-21—National summer meeting of the Institute of Aeronautical Sciences, 7660 Beverly Blvd., Los Angeles.

June 19—Council of the International Civil Aviation Organization, 10th session, Caracas, Venezuela.

June 20-22—Aviation Distributors and Manufacturers Assn., 27th meeting, Grove Park Inn, Asheville, N. C.

June 25-27—High Temperature Symposium, Berkeley Campus, University of California.

June 28-30—Institute of Navigation's 12th annual national conference, Hotel Miramar, Santa Monica, Calif.

June 30—Jet Age Conference, Sheraton-Jefferson Hotel, St. Louis, Mo.

July 7-10—Tenth annual All-Woman Transcontinental Air Race (Powder Puff Derby), San Mateo County Airport, Calif. to Flint, Mich. Entries close June 20. For details write: Mrs. Betty M. Loufek, Loufek & London, 2611 E. Spring St., Long Beach 6, Calif.

July 8—Third annual Western New York Air Show and Races, Niagara Falls Municipal Airport, Niagara Falls, N. Y.

July 15-30—World Parachuting Championship, Moscow, Russia.

July 31-Aug. 9—23rd Annual U. S. National Soaring Competitions, Aug. 5—Air Show, Grand Prairie Airport, Grand Prairie, Texas.

Aug. 1-5—Air Force Association's 1956 National Convention and Airpower Panorama, Roosevelt Hotel, New Orleans, La.

AVIATION WEEK • JUNE 11, 1956
Vol. 64, No. 24

Published weekly with an additional issue in December by the McGraw-Hill Publishing Company. James H. McGraw (1860-1948), Founder. Executive, Editorial, Advertising and Subscription offices: **McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y.** Publication offices: 99-129 North Broadway, Albany 1, N. Y. Donald C. McGraw, President; Paul Montgomery, Executive Vice-President; Joseph A. Gerardi, Vice President and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice President, Publications Division; Ralph B. Smith, Vice President and Editorial Director; Joseph T. Allen, Vice President and Director of Advertising Sales; J. E. Blackburn, Jr., Vice President and Circulation Director.

Subscription; Address correspondence to AVIATION WEEK—Subscription Service, 99-129 North Broadway, Albany 1, N. Y. or 330 West 42nd St., New York 36, N. Y. Allow 10 days for change of address.

Subscriptions are solicited only from persons who have a commercial or professional interest in aviation. Position and company connection must be indicated on subscription orders.

Single Copies 50¢. Subscription rates—United States and possessions, $6 a year; $9 for two years; $12 for three years. Canada $8 a year; $12 for two years; $16 for three years, payable in Canadian currency at par. Other Western Hemisphere and the Philippines $10 a year; $16 for two years; $20 for three years. All other countries, $20 a year; $30 for two years; $40 for three years. Second class mail privileges authorized at Albany 1, N. Y. Printed in U. S. A.

Copyright 1956 by McGraw-Hill Publishing Co. Inc. All Rights Reserved. Cable Address: "McGraw-Hill New York." Publications combined with AVIATION WEEK are AVIATION, AVIATION NEWS, AIR TRANSPORT, AERONAUTICAL ENGINEERING and AIRCRAFT JOURNAL. All rights to these names are reserved by McGraw-Hill Publishing Co.

The Chance-Vought Regulus takes to the air. Precision actuating assemblies for this and other guided missiles are part of Ex-Cell-O's production.

Four typical actuating assemblies precision-built by Ex-Cell-O for planes and guided missiles.

You Can Be Confident of Precision
With Ex-Cell-O Parts or Assemblies

Almost every plane you see streaking across American skies, flies with Ex-Cell-O precision parts or assemblies—precision-built to fulfill ever more rigid design specifications.

From design to final inspection skilled personnel, working with the most complete manufacturing facilities available, build precision into every part and assembly. That's why the aircraft industry has placed confidence in Ex-Cell-O for over 30 years.

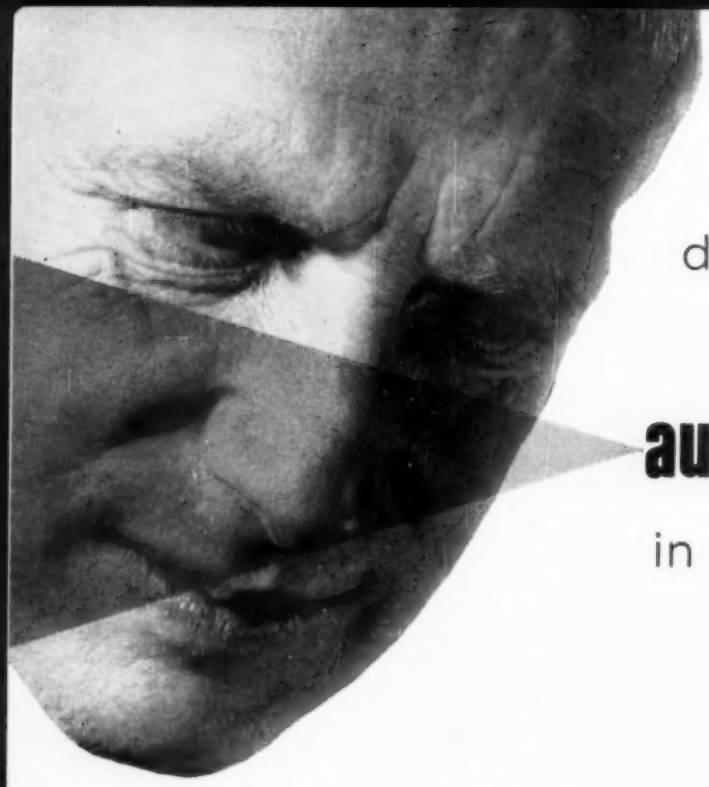
For parts or assemblies that meet your most rigid specifications—that meet your delivery schedules—send your print or sketch to:

55-42

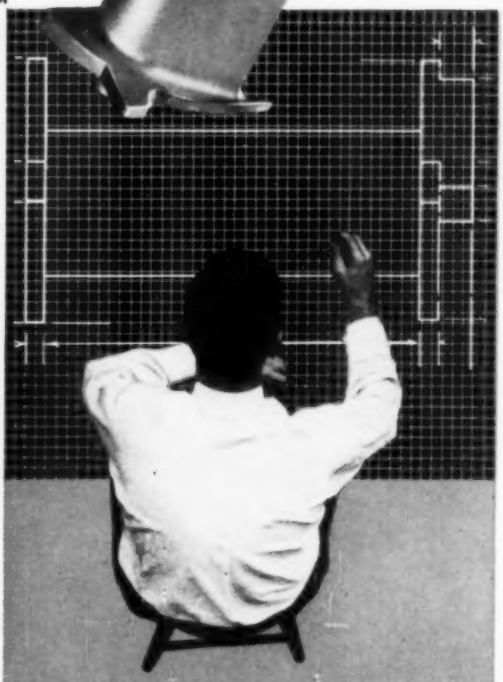
XLO
EX-CELL-O for PRECISION

EX-CELL-O CORPORATION • DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT



design
with
austenal
in mind



microcast *quality control starts with the blueprint...*

Quality Control at Austenal begins in the planning stage . . . long before any actual manufacture of parts is undertaken.

In order to achieve the finest finished product, design engineers consult first with Austenal engineers and profit from their experience and advice. Thus, you can *design directly for Microcast* and take advantage of the special features it makes possible.

During manufacture, many separate and vital Quality Control steps check production – from the initial alloy melt to critical examination for dimensional accuracy and internal structural soundness.

Quality Control works hand in hand with advanced research to improve and maintain Microcast techniques and applications. For this purpose, Austenal maintains the industry's finest, most advanced research facilities.

Think *Austenal* when you design. You'll be sure that high quality and maximum performance will be *built right from the beginning* into any product you require.

austenal
LABORATORIES, INC.
microcast division
224 EAST 39th STREET, NEW YORK 16, N. Y.
7001 SOUTH CHICAGO AVE., CHICAGO 37, ILL.

...It's **NEW** *from Austenal*

After-burner nozzle segments, impractical and prohibitively expensive to manufacture by any other means, are produced by Austenal to exacting aircraft standards.

Write today for Austenal's latest booklet, "Design with Microcast in Mind."

NEW MUSCLES FOR SKY GIANTS

End view of propellant grain showing internal star configuration.

with "Tailor-Made" Propellants

by Olin

The Olin Explosives Division's leadership in both double-base and composite propellant technology offers designers and engineers "tailor-made" solid rocket power plants. Given your requirements for thrust and duration, an optimization of performance characteristics is made possible through selection from a wide spectrum of propellants.

Where requirements dictate the discovery and utilization of new propellants, Olin's complete laboratories and testing facilities give developmental projects every expectancy of early success. So why not call Olin the next time a problem can possibly be solved by up to date technology in the solid propellant propulsion field. A capable group of explosives and propellant specialists is ready to help.

Employment Inquiries Are Invited From Qualified Engineers And Scientists.

OLIN SOLID PROPELLANTS AND EXPLOSIVE PRODUCTS ARE READY FOR USE IN THE FOLLOWING APPLICATIONS

- Missile Propulsion Units, Boosters, Retarding and Attitude Control Rockets, Sustainer and ATO Motors
- High Speed Rocket Sled Engines
- Solid Propellant Turbo Jet Engine Starter Cartridges
- Gas Generation and Auxiliary Power Units
- Power Packages for External Stores, Canopies and Pilot Seat Forced Ejection Systems
- High Explosives, Ignitors, Fuses, Detonators, Flares, Pyrotechnics
- Explosive Formation of Metal Parts

Olin
TRADEMARK
EXPLOSIVES DIVISION
OLIN MATHIESON CHEMICAL
CORPORATION
EAST ALTON, ILLINOIS

2220 HANDS *work together at Chandler-Evans . . . to produce the finest*

AIRCRAFT FUEL CONTROL SYSTEMS and COMPONENTS

Here at the Chandler-Evans plant in West Hartford, young, aggressive and imaginative engineers join forces with seasoned specialists who contribute valuable experience gained in years of significant achievement. Here, RESEARCH works in completely equipped, modern laboratories to provide the advanced data on which ENGINEERING bases always newer, finer designs. And PRODUCTION converts these designs into the precision fuel control systems and aircraft components that have played a vital part in establishing so many of the important "firsts" in aviation's progress.

To Young Engineers

Chandler-Evans offers *careers* in Creative Engineering. Here — for aggressive young men capable of original thinking who want to see their ideas realized — are opportunities to work under experienced specialists on important developmental projects that will provide full scope for your abilities and help you grow in your profession. Write directly to our Chief Engineer, Mr. A. M. Wright.

When you work with CECO, your projects are in good hands!

CECO *Chandler-Evans*

CHARTER OAK BOULEVARD, WEST HARTFORD 1, CONN.

Makers of Jet Aircraft Accessories Produced Today to Meet Tomorrow's Progress

10,000
Lear ADF-12's
have pointed the way
for more than
5,000,000 hours

Lowest in price
Lightest in weight
Simplest in operation

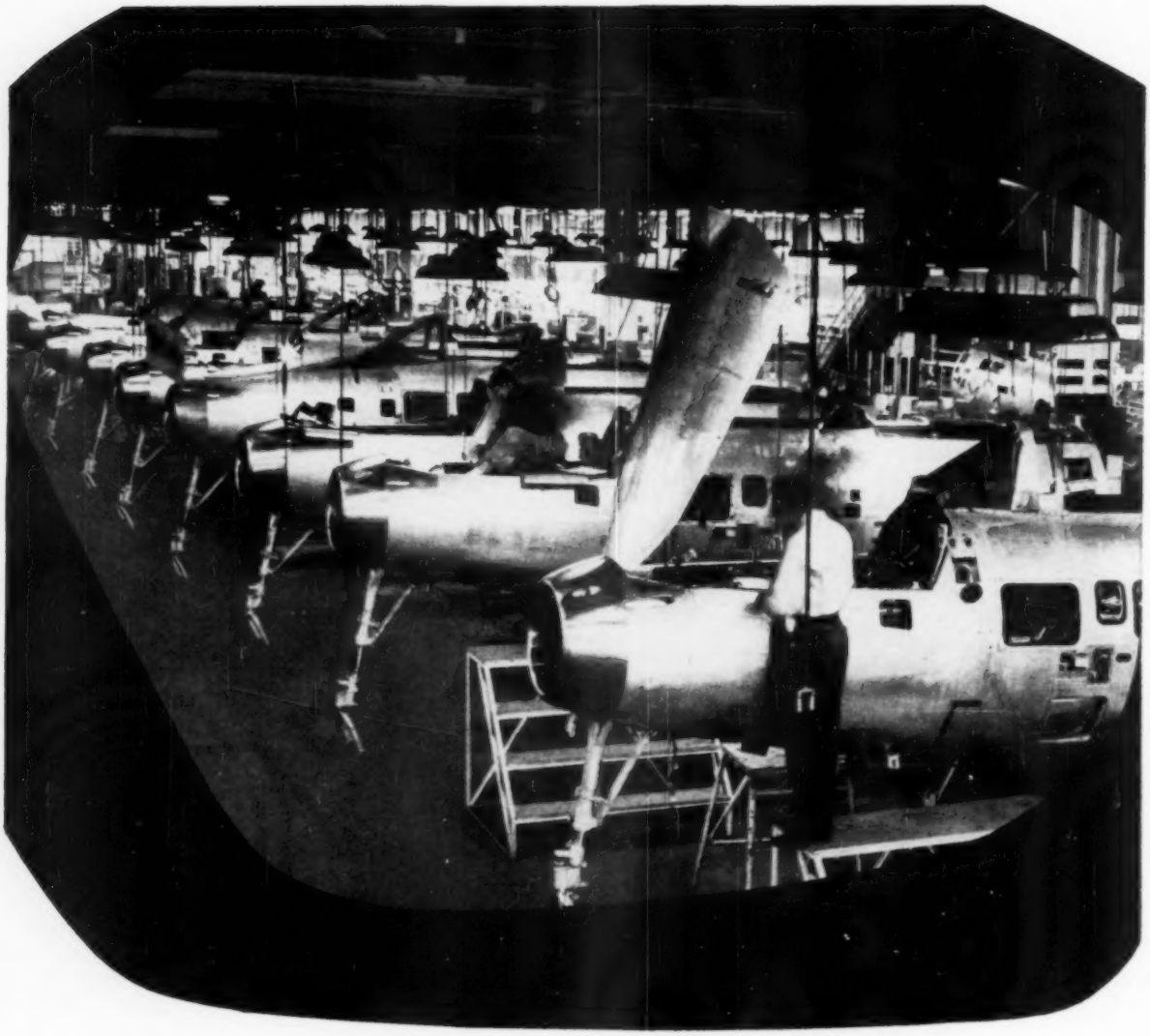
air man's best friend

LEAR ADF-12

...points the way automatically

LEAR INC., LearCal Division—3171 South Bundy Drive, Santa Monica, California

LC-29



New Thunderjets for old

Between now and next fall, scores of Republic F-84G Thunderjets will move through two of Temco's three plants. They represent Temco's *first* contract for overhaul-modification of jet aircraft — a contract that calls for completion of work on 169 of these U.S.A.F. fighters within six months.

Fast work — but typical of Temco's ability to adapt quickly to the demands of new jobs, new responsibilities.

Overhaul-modification is only one phase of Temco's complete service. Its three integrated plants offer every facility for handling any kind of aircraft work — from initial design through every step of tooling, engineering, fabrication and assembly.

Temco has the size, the skills, and the experience to handle any project efficiently, on schedule, and at most competitive cost. These abilities can be used to the benefit of your company. Let Temco show you!

Engineers: openings in all phases of aircraft design and development.

TEMCO

AIRCRAFT CORPORATION.

DALLAS

Improve Teflon® hose installations with PREFORMED assemblies

FLUOROFLEX®-T R-3800 hose assemblies, supplied permanently preformed by the factory, eliminate stress and strain in the critical bends. Preforming permits bend radii to range from just ¾" for the –4 hose to only 5" for the –20 hose . . . with minimum restriction of inside diameter.

Lines are permanently formed to clear obstructions and make connection in shortest possible length. Combining the best advantages of pipe and hose, these preformed assemblies save space, weight, eliminate need for special elbows and make for efficient, neat plumbing design.

Fluoroflex-T hose has –100° to +500°F ambient temperature range, 1000 psi working pressure, and *complete* inertness to all oils, fuels, propellants. Approved by the Services and CAA, it is the *original* Teflon hose . . . the only Teflon hose with over 3 years' flight service. Now used in fighters, bombers, missiles, helicopters, commercial transports. Send for data.

RESISTOFLEX CORPORATION, Roseland, New Jersey; Western Plant: Burbank, Calif.

® DuPont trade mark. • ® Resistoflex trade mark.

20th year of service to industry

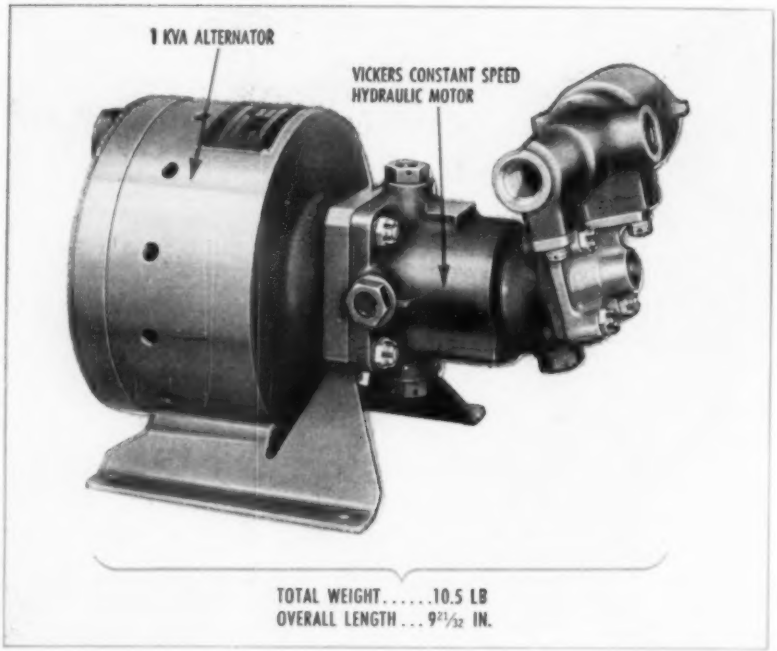
Resistoflex

New Vickers Airborne Electrical Power Package

. . . Saves Weight and Space

Utilizes the Hydraulic System for More Efficient Production of AC Power

This new isolated electrical power package provides closely regulated AC power with minimum weight and envelope while drawing its power from a hydraulic system. In new designs or when adding electronic equipment to aircraft designs in which the electrical system is already loaded to capacity, this versatile package provides the needed AC power from flow available in the hydraulic system. This generally is permissible without system change as the full flow is seldom demanded except for a few seconds under rare circumstances. Even in such cases, full flow can be guaranteed to these hydraulic functions through the use of a simple priority valve which starves the AC power package momentarily.



Less Weight and More Efficient

Important weight savings are achieved through the use of this package instead of an inverter which may also require an increase in the AC generator and line capacities. In one instance, the 10.5 lb 1 kva package replaced a 38 lb inverter for co-pilot instrumentation. An additional advantage is that the package has 62% overall efficiency while that of the inverter was 35-40%.

Extreme altitude operation is no problem as the Vickers isolated electrical power package contains no brushes or other altitude-sensitive components.

Features of AC Generator

The permanent magnet type AC generator has excellent life and reliability. It requires no bulky voltage regulator . . . is inherently smaller and lighter than conventional generators due to the elimination of the exciter and slip rings. It also has higher overall efficiency resulting from elimination of all excitation losses. Additional advantages are that the permanent magnet is unaffected by momentary short circuit, or separation of field and armature without keeper, or by temperature cycling. It is also not susceptible to aging or shock. This unit is 120/208 volt, three phase, wye connected with 400 cps at 8000 rpm. It is capable of continuous duty under environments of 0-55,000 feet altitude and ambient temperatures from −65 F to 250 F.

Hydraulic Motor Drive

The generator is directly driven by a Vickers Constant Speed Hydraulic Motor having fixed stroke and an integral flow control valve that maintains an 8000 rpm speed setting within ±2½% regardless of the load (as long as valve inlet pressure is greater than load requirement). For the unit shown above, maximum operating pressure is 3000 psi while rated output of 1 kva requires operating pressure of 2200 psi. Special configurations will maintain 400 cps frequency within ±0.1% regardless of load. This motor has a very high horsepower-weight ratio and its overall efficiency exceeds 92%. It is a time-proved design capable of many hundreds of hours of continuous service without attention.

Many Uses and Sizes

The applications for this isolated power source are numerous. For multi-engine aircraft, its use for co-pilot instruments provides dual reliability. This package has been used to supply controlled frequency AC power in emergencies when the only source of power in the airplane is a ram air turbine driven pump. The efficiency of this arrangement minimizes the size and weight of the ram air turbine necessary to provide emergency hydraulic and electric power.

Now available in the sizes listed below, larger packages can also be supplied from existing components. Vickers is prepared to develop the package best suited to a specific need. For further information, get in touch with your nearest Vickers Aircraft Application Engineer.

Vickers Airborne Electrical Power Packages

kva output	weight, pounds
0.5	7.0
1.0	10.5
1.5	12.5
2.0	15
2.5	17
3.0	19

Larger capacities with minimum weight are available.

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
ADMINISTRATIVE and ENGINEERING CENTER
Department 1462 • Detroit 32, Michigan
Aircraft Application Engineering and Service Offices: El Segundo, California, 2160 E. Imperial Highway • Detroit 32, Michigan, 1400 Oakman Blvd. (Service Only) • Arlington, Texas, P. O. Box 213 • Washington 5, D.C., 624-7 Wyatt Bldg. Additional Service facilities at: Miami Springs, Florida, 641 De Soto Drive
TELEGRAMS: Vickers WUX Detroit • TELETYPE "ROY" 1149
CABLE: Videt
OVERSEAS REPRESENTATIVE: The Sperry Gyroscope Co., Ltd. Great West Road, Brentford, Middx., England

Engineers and Builders of Oil Hydraulic Equipment Since 1921

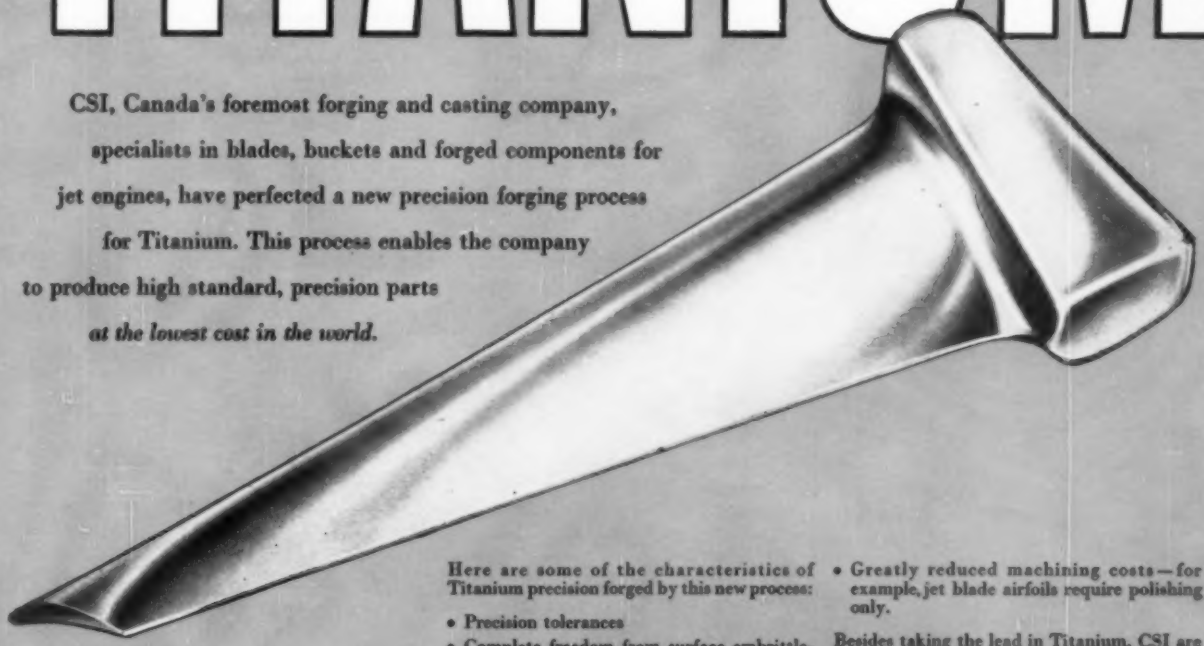
7492

NOW . . . DOUGLAS

Canada NOW leads the world in

LOW COST PROCESSING *of*

TITANIUM



CSI, Canada's foremost forging and casting company, specialists in blades, buckets and forged components for jet engines, have perfected a new precision forging process for Titanium. This process enables the company to produce high standard, precision parts *at the lowest cost in the world.*

Here are some of the characteristics of Titanium precision forged by this new process:

- Precision tolerances
- Complete freedom from surface embrittlement due to gaseous contamination.
- Excellent surface finish.
- Consistent quality maintained.
- Greatly reduced machining costs—for example, jet blade airfoils require polishing only.

Besides taking the lead in Titanium, CSI are also highly skilled and experienced in the production of high temperature alloy forgings and in forgings and castings of aluminum and magnesium.

CSI

Write for further details

CANADIAN STEEL IMPROVEMENT LIMITED

HORNER AND SECOND AVENUES,
TORONTO 14, ONTARIO

Represented in the United States Only by—

C. F. RUSSELL COMPANY INC.

Offices:

Newington, Connecticut	Bay Shore, New York	Kansas City, Missouri	Los Angeles, California
Tel: Mohawk 6-4462	Tel: Bay Shore 7-2623	Tel: Baltimore 7992	Tel: Granite 9-2202

6614-R

NOW . . . DOUGLAS

specifies World's Fastest Fire Detector to protect USAF's GIANT C-133A

Speed-of-light response . . . and reliability of detection . . . are the vital factors of safety essential for the harnessed volcanoes in today's aircraft. Now FIREYE* stands guard in the Douglas C-133A, the world's largest cargo-carrying aircraft. A growing number of plane builders have chosen FIREYE for maximum protection from fire aloft. Write for complete information.

*Protected by U.S. and foreign patents issued and pending.

fireye DIVISION

ELECTRONICS CORPORATION OF AMERICA

77 Broadway, Cambridge, Mass.

PHOTOSWITCH DIVISION • COMBUSTION CONTROL DIVISION
PHOTOCONDUCTOR-TRANSISTOR DIVISION • MARINE DIVISION
MILITARY DIVISION • BUSINESS MACHINES DIVISION

"ENEMY" JET AT ONE O'CLOCK!

The ultimate target for a weapons system is the enemy. Lacking that ultimate target for training, the jet-powered Firebee has been developed by Ryan in cooperation with the U.S. Air Force, U.S. Navy, and U.S. Army. It is the first realistic target which can "stand-in" for the enemy to sharpen the sights of the pilots, gunners, missile crews and radarmen who man America's defense system. No other vehicle can be used so effectively to evaluate new weapons systems.

Remotely controlled, the Firebee is a jet-fast "flying bull's-eye" that can operate at the extremely high speeds and high altitudes of modern air combat. Launched from the air or ground, and recovered by parachute, it is economical, not only in original cost, but also throughout its extended operational life, because it can be used over and over again.

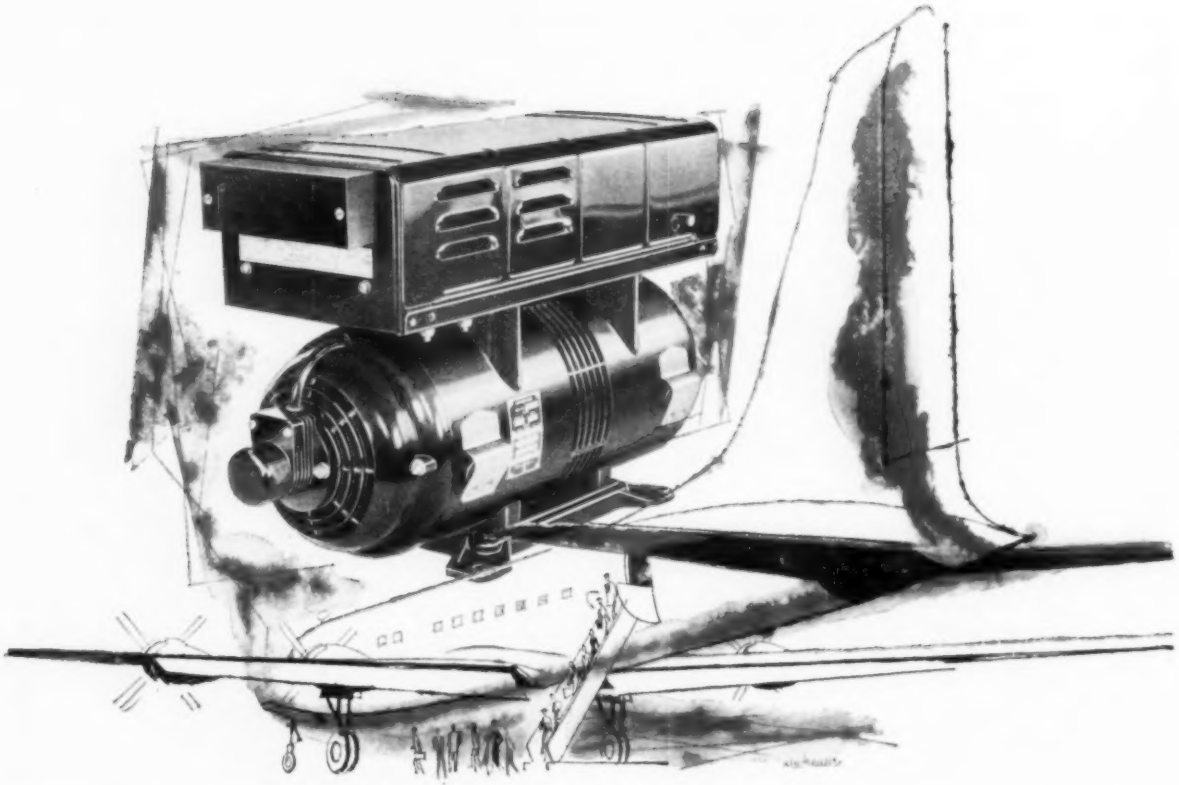
Currently in production and being used operationally, Firebees have been delivered to all three military services – Air Force (Q-2A), Navy (KDA-1) and Army (XM21).

The Firebee is dramatic proof of Ryan's skill in blending aerodynamic, jet propulsion and electronics knowledge to solve a complex aviation problem . . . meet a military need. Ryan's jet-powered VTO now being tested at Edwards Air Force Base is another example of Ryan's forward-looking engineering ability.

Engineers looking for a challenging future will find outstanding opportunities at Ryan.

With a background of 33 years of experience in aviation, Ryan excels in designing and producing high quality aircraft, power plants and avionics, built at low cost, delivered on time.

RYAN
AERONAUTICAL COMPANY
SAN DIEGO 12, CALIFORNIA



3000-VA INVERTER...SIMPLIFIES A-C POWER BOOST FOR AIRLINES!

To fulfill the requirements of commercial airlines for increased electric system capacity, a necessity when installing radar and other special a-c devices, Jack & Heintz has perfected a 3000-volt-ampere inverter, the F45-10.

The 3000-va inverter represents a 20% power boost over inverters now on the market. Through careful design, this 20% increase in output has been accomplished with less than a 2% increase in total weight and with no increase in space requirements.

To simplify maintenance and parts stocking problems, 90% of the parts used in the unit are completely interchangeable with the popular 2500 va—J & H model F45-5.

The new model F45-10 is available, immediately, for replacement installations. Or, existing 2500-va F45-5's may be quickly and easily converted for 3000-va output with a conversion kit. In either case, the additional 500-va increase in output is obtained with a total weight penalty of only one-half pound.

Send for product data bulletin No. 1344 for detailed information on this important Jack & Heintz first. Write Jack & Heintz, Inc., 17635 Broadway, Cleveland 1, Ohio. Export Department: 13 East 40th Street, New York 16, New York.

F45-10 INVERTER
Operating Characteristics

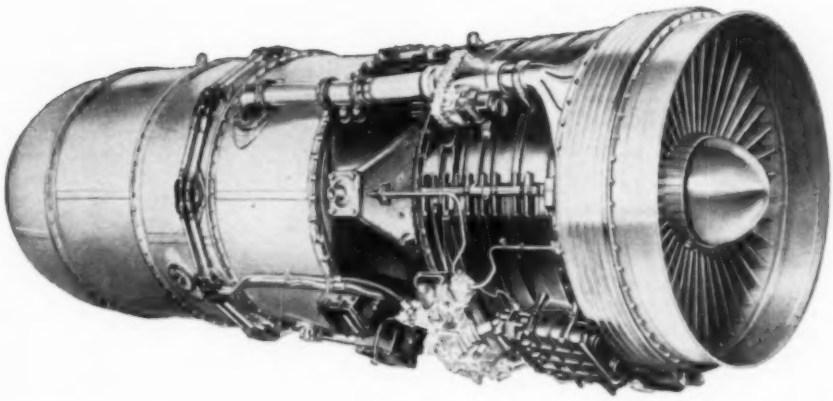
	Single Phase*	Three Phase
Output Rating		
Full Load	3000 va	3000 va
Rated a-c Voltage	115	115
Line Amps	24	15
Nominal Frequency (cps)	400	400
Power Factor	90% Lag to 95% Lead	
Rated Input Voltage — d-c	27½	27½
Input Amperes — d-c (at Rated Voltage)		
No Load	44	44
Full Load	185	185
Over-all Dimensions—Inches		
Length	17 13/16	
Width	7 1/16	
Height	11 13/16	
Weight—Pounds	54	

* Load across terminals BA

JACK & HEINTZ ELECTRIC AIRCRAFT EQUIPMENT

HIGH THRUST · LIGHT WEIGHT

LOW CONSUMPTION



ROLLS-ROYCE CONWAY

BY-PASS JET ENGINE

ROLLS-ROYCE LIMITED · DERBY · ENGLAND

Sightseeing at 700 m.p.h.-**NAVY STYLE**

A jet-propelled "camera strike" pays off—as a Navy "eye" streaks in low under enemy radar—zooms to proper height—drops its flares and snaps intelligence pictures. Clear pictures are assured, despite the extreme speed, because Librascope photo-reconnaissance equipment is part of the mission. But getting the picture is only part of the job. The data must be correctly interpreted back at home base. Here Librascope photogrammetric equipment assures final success of the mission.

Librascope is noted for important developments in military science, including pilot and navigator viewfinders, periscopes, fire control systems and airborne computers. This reputation has been built on advanced engineering skills in optical, electronic, mechanical and analog/digital computer technology. If you are concerned with military or commercial projects—specialized engineering personnel and exceptional facilities are available to you at Librascope for research development and production.

ENGINEERS...*learn about Librascope's new creative "Project Development Teams"... write Don Webster, Chief Engineer*

LIBRASCOPE

A SUBSIDIARY OF GENERAL PRECISION EQUIPMENT CORPORATION

LIBRASCOPE, INC. · 808 WESTERN AVE. · GLENDALE, CALIFORNIA

JUNE 11, 1956

AVIATION WEEK

VOL. 64, NO. 24

New York 36—330 W. 42nd St., Phone: LOngacre 4-3000 (Night LO 4-3035)

Editorial Offices Washington 4, D. C.—National Press Bldg., Phones: NAtional 8-3414, REpublic 7-6630

Los Angeles 17—1125 West Sixth St., Phone: MAdison 6-9251

PUBLISHER.....Robert W. Martin, Jr.
EDITOR.....Robert B. Hotz

MANAGING EDITOR.....Alpheus W. Jessup
ASST. MANAGING EDITOR (TECHNICAL) David A. Anderton
WASHINGTON.....Cecil Brownlow
NEW YORK.William Gregory, James J. Dailey
LOS ANGELES.Irving Stone, Richard Sweeney
ENGINEERING.....Robert H. Cushman, Russell Hawkes
AVIONICS.....Philip J. Klass
CONGRESS.....Katherine Johnsen
MILITARY....Claude O. Witze, Evert Clark
TRANSPORT....Craig Lewis, Glenn Garrison, L. L. Doty
EQUIPMENT.....G. L. Christian
BUSINESS FLYING.....Erwin J. Bulban
ART EDITOR.....Lawrence J. Herb
EDITORIAL PRODUCTION....Jerome E. Kelley
EDITORIAL ASSISTANTS Bernie Lang, Betty Hein
LIBRARIAN.....Jeanne Rabstejnek

FOREIGN NEWS SERVICE

EDITOR.....John Wilhelm
LONDON..... William J. Coughlin
PARIS.....Robert E. Farrell
BONN.....Gerald W. Schroder
MEXICO CITY.....John H. Kearny
RIO DE JANEIRO.....Peter Weaver
TOKYO.....Dan Kurzman

DOMESTIC NEWS BUREAUS

ATLANTA 3.....801 Rhodes-Haverty Bldg.
CHICAGO 11.....520 No. Michigan Ave.
CLEVELAND 15.....1510 Hanna Bldg.
DETROIT 26.....856 Penobscot Bldg.
HOUSTON 25.....1303 Prudential Bldg.
LOS ANGELES 17.....1125 West Sixth St.
SAN FRANCISCO 4.....68 Post St.
WASHINGTON 4...1189 National Press Bldg.

SALES

ADVERTISING SALES MANAGER E. P. Blanchard, Jr.
PROMOTION and RESEARCH MANAGER W. H. Jack
ATLANTA.....W. H. Kearns
BOSTON .....A. C. Boughton
CHICAGO and ST. LOUIS.....J. S. Costello, F. E. Bauman
CLEVELAND.....H. P. Johnson
DALLAS.....Gordon Jones, Douglas Billian
DETROIT.....C. A. Ransdell
LOS ANGELES.....C. F. McReynolds, D. T. Brennan
NEW YORK.....M. J. Storz
PHILADELPHIA...W. S. Hessey, J. D. Willis
SAN FRANCISCO.....William Woolston

BUSINESS

BUSINESS MANAGER.....J. G. Johnson
PRODUCTION MANAGER.....W. V. Cockren

RESEARCH AND MARKETING

Mary Whitney Fenton, Elinore Eisenson, Joan Read

Single Defense for U. S., Canada Proposed..... 26

▶ General Partridge tells Senate Airpower Committee that Alaska, Northeast, Canadian Air Commands run their own defenses.

ANDB Finds Tacan Fit for Common System..... 38

▶ Technical objections are answered in report, but questions of timing and international reaction remain to be settled.

F-102A Pioneers Production Concept..... 50

▶ First airplane to be ordered under Cook-Craigie system meant gamble on tooling, but paid off when area rule dictated changes.

AERONAUTICAL ENGINEERING

Russian Bear 27
First Complete Jet Parts Lab..... 28
Crusader Wing Details..... 29
AF, AEC, Navy Plan Weapons Range. 33
New Hunter Mk. 6..... 33
Ryan Vertiplane Uses Double Flaps.. 34
Cave, Water Head Cut Air Flow Cost. 65
Russians Name Engine Designer..... 67
New Firebee to Fly Above 50,000 Ft. 64
Production Briefing 69

AVIONICS

New Auto-Navigator Corrects Itself.. 71
Expansions, Changes in Avionics.... 81
Filter Center 83
New Avionic Products 87

BUSINESS FLYING

Private Flying Plans With Curtis.... 29
Piper's Laminar-Flow Comanche 109
Beech Gear Eases Crosswind Landings 111
Private Lines 115

EQUIPMENT

Seals Designed for Supersonic Speeds 97
Off the Line 102

SAFETY

CAB Report on Lodestar Crash..... 121

TRANSPORT

CAB Investigates Reservations..... 38
Kerosene Claimed Safer for Jets.... 39
Eastern-Colonial Join 39
IATA Conference Probes Traffic Snarl 41
Rising Cost of Airliners..... 43
Orders for Viscounts at 316..... 45
CAB Nod to Southern..... 45
Boeing Weighs Short-Range Jet..... 45
CAB Orders 45
Shortlines 47
Cockpit Viewpoint 47

FINANCIAL

USAF Contracts 103
Army Contracts 107
Navy Contracts 107

MANAGEMENT

Renegotiation Extension Probable... 28
USAF's Interservice Policy..... 31
Logistics Pinch Turns C-123 to Cargo 32
Cleveland Employes Walk Out..... 34
Who's Where 23, 92
Industry Observer 23
Washington Roundup 25
News Digest 34

Calendar 5
Letters 146

EDITORIAL

North Atlantic Fare Battle..... 21

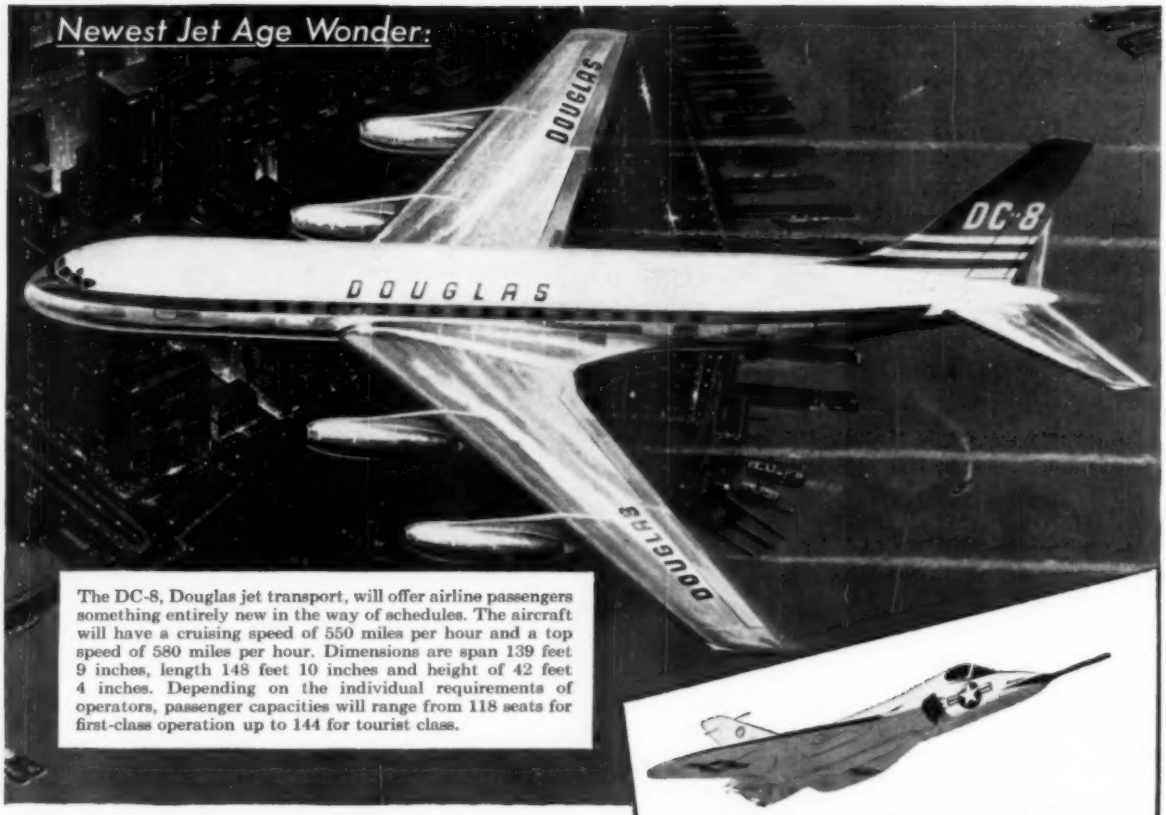
COVER: Convair F-102A interceptor is going into service with the Air Defense Command. Equipped with Pratt & Whitney J57 engine, the F-102A has a top altitude of approximately 54,000 ft. An F-102B series, using the P&W J75, is being phased into production at Convair's Plant 2. F-102 production, the first under the Cook-Craigie plan, is described on p. 50.

Picture Credits:
30—Howard Levy.

63,477 copies of this issue printed

AVIATION WEEK • JUNE 11, 1956 • Vol. 64, No. 24
Member ABP and ABC

Newest Jet Age Wonder:



The DC-8, Douglas jet transport, will offer airline passengers something entirely new in the way of schedules. The aircraft will have a cruising speed of 550 miles per hour and a top speed of 580 miles per hour. Dimensions are span 139 feet 9 inches, length 148 feet 10 inches and height of 42 feet 4 inches. Depending on the individual requirements of operators, passenger capacities will range from 118 seats for first-class operation up to 144 for tourist class.

New Douglas DC-8

JET TRANSPORT

brings super speeds to civilian flight

The newest Douglas contribution to the jet age, the new DC-8 is destined to make radical changes in intercontinental scheduling of civilian flights. Macwhyte "Hi-Fatigue" control cable is utilized for the control installations in the new DC-8. Indeed, all three Douglas plants in Southern California—Santa Monica, El Segundo, and Long Beach—use Macwhyte cable for installation on planes like those shown on this page.

The F4D is designed to climb quickly to high altitude and destroy enemy aircraft before they can attack a vital target. The delta-wing Navy speedster has a span of 33 feet 6 inches, length of 45 feet 8 inches and a height of 13 feet. It is powered by a Pratt & Whitney J57 engine. It set the world's official air speed record (3 km. course) on October 3, 1953 with a mark of 752.9 mph. Two weeks later it broke the 100 km. closed course record with a speed of 728.11 mph.

The RB-66, reconnaissance version of the B-66 bomber, is an aircraft of the 600-700 mile per hour class. This latest addition to the Air Force tactical reconnaissance capability has a span of 72 feet 6 inches, length of 75 feet 2 inches and a height of 23 feet 7 inches. It is powered by two Allison J71 engines.

Because it is properly PREformed, "Hi-Fatigue" cable lies dead with no tendency to twist or curl. Assemblies can be made to closer tolerances, and there is minimum uniform stretch in any length. Macwhyte makes a complete line of sizes and types of "Hi-Fatigue" aircraft control cable in Galvanized, Tinned, and Stainless Steel. Macwhyte aircraft products meet the requirements of aircraft manufacturers, air lines, and military specifications.

Aircraft Catalog A-3 free on request.

MACWHYTE

CABLE · TERMINALS · ASSEMBLIES · TIE-RODS

2905 Fourteenth Avenue, Kenosha, Wisconsin

Manufacturers of "Hi-Fatigue" Aircraft Cable—"Safe-Lock" Cable Terminals—Cable Assemblies—Tie Rods—Braided Wire Rope Slings—Bright, Galvanized, Stainless Steel, and Monel Metal and Plastic Coated Wire Rope.

MILL DEPOTS:

New York 4, 35 Water St.
Pittsburgh 19, 704 Second Ave.
Chicago 6, 228 So. Desplaines St.
Detroit 3, 75 Oakman Blvd.
St. Paul 14, 2356 Hampden Ave.
Ft. Worth 1, P.O. Box 605
Portland 9, 1603 N.W. 14th Ave.
Seattle 4, 87 Holgate St.
San Francisco 7, 188 King St.
Los Angeles 21, 2035 Sacramento St.

EDITORIAL

North Atlantic Fare Battle

The current controversy over reducing the level of North Atlantic airline fares requires thoughtful analysis and cool tempers if a sound decision is to be reached that will benefit all countries concerned with this lucrative and highly competitive traffic pool. The machinery of the International Air Transport Association Air Traffic Conference now grinding at Cannes has handled many similar rate conflicts in the past. If kept clear of some narrow nationalistic flag-waving now going on outside the conference corridors, it appears that a reasonable solution may emerge from its deliberations.

This conflict over the rate at which air transport should be pushed into a mass transportation medium has been a point of controversy on both the domestic and international scene ever since the appearance of post-war transports such as the Douglas DC-6 and DC-7 series and the Lockheed Constellation line. These aircraft made mass air transportation technically feasible and economically necessary. There have been conservative airline management viewpoints on both sides of the Atlantic that cautioned against the shifting of air transport from a relatively high-fare luxury service to a low-fare mass transportation media.

The Low-Fare Boom

Nowhere has the fallacy of this conservative viewpoint been disproved so thoroughly by experience than on the North Atlantic. Since the introduction of low-fare tourist service on this route in 1952, traffic has more than doubled; 800,000 passengers were flown between the United States and Europe in 1955, and a 20% increase over this all-time record is the prospect for 1956.

More than 70% of this North Atlantic traffic flies low-fare tourist service. For the second consecutive year this rising tourist-fare traffic will enable the airlines to supplant steamships as the prime carrier on the North Atlantic.

Since the introduction of tourist service the Atlantic operations of both Trans World Airlines and Pan American World Airways have been able to stand on their own economically and get off government subsidy. Foreign flag carriers who last year carried 38% of this expanded transatlantic market are certainly benefiting in proportion from the tourist boom.

Even more important from the European viewpoint is the flood of folding green American dollars that the transatlantic carriers bring to Europe each year. U. S. citizens comprised 72% of the total transatlantic traffic in 1955.

American tourists bent on spending their vacation money in Europe comprise the great bulk of North Atlantic air traffic. Last year American tourists spent $1½ billion in foreign countries—the vast majority of it in Europe.

Tourists and European Prosperity

The flow of U. S. tourist dollars into Europe is in no small measure responsible for the general air of prosperity that now prevades the continent and the British Isles. If the North Atlantic carriers can tap an entirely new economic level of American traveler that will substantially increase this flow of tourist dollars to Europe, they will be performing an extremely valuable service in the cycle of foreign trade and prosperity.

There is no doubt that the introduction of the new lower tourist rates proposed by Pan American and TWA would cause problems for European airline managements. It might be more comfortable to postpone the impact of these problems indefinitely. There also is no doubt that the airlines with the best equipped transport fleets and the most transatlantic seats to sell will benefit the most from any new penetration of the mass transport market.

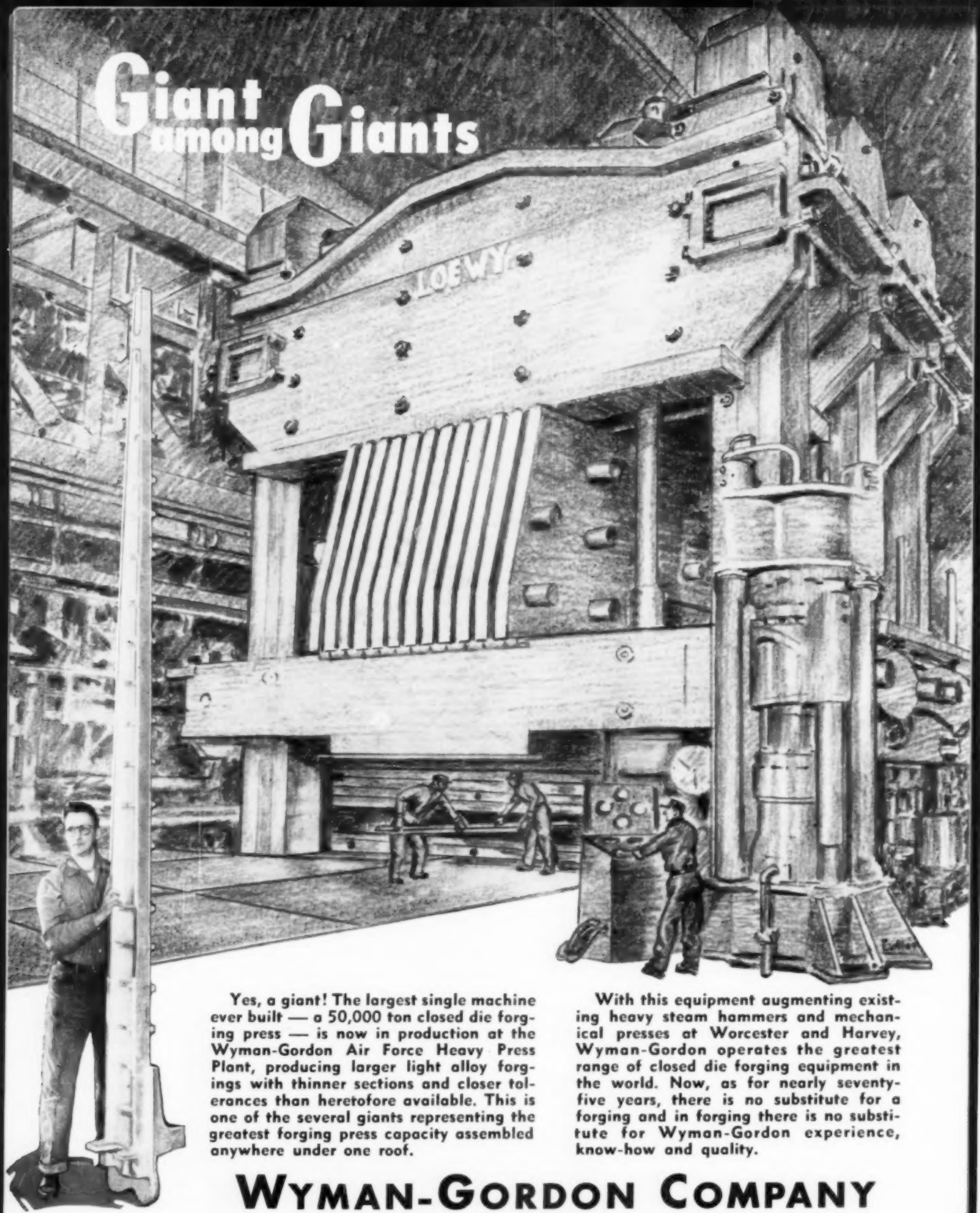
However, the development of a mass transport market that will dwarf even the record statistics of current air travel is an absolute necessity if airlines are to remain economically sound in the jet transport age that looms so close on the horizon. The huge capacity of the jet liners plus velocity of their operation will create a tremendous seating capacity that must be filled if the airlines are not to sink back into financial insecurity and heavy government subsidy.

Make the Move Now

The sooner the airlines bend every effort to developing the mass transport market, the better off they will be in weathering the economic impact of the jet transport age. This mass transport market must be developed BEFORE, not after, the jets arrive unless the airlines wish to face the same type of financial straits that gripped them immediately after World War II and just before they plunged into low-fare coach operations.

There may be some legitimate arguments over the exact level at which new reduced North Atlantic fares should be set, but there can be no room for argument over whether fares should be further reduced and whether further reductions will increase air travel volume. The record of low-fare tourist service on the North Atlantic during the past three years has made the record on this point clear.

—Robert Hotz



Yes, a giant! The largest single machine ever built — a 50,000 ton closed die forging press — is now in production at the Wyman-Gordon Air Force Heavy Press Plant, producing larger light alloy forgings with thinner sections and closer tolerances than heretofore available. This is one of the several giants representing the greatest forging press capacity assembled anywhere under one roof.

With this equipment augmenting existing heavy steam hammers and mechanical presses at Worcester and Harvey, Wyman-Gordon operates the greatest range of closed die forging equipment in the world. Now, as for nearly seventy-five years, there is no substitute for a forging and in forging there is no substitute for Wyman-Gordon experience, know-how and quality.

WYMAN-GORDON COMPANY

Established 1883

FORGINGS OF ALUMINUM • MAGNESIUM • STEEL • TITANIUM

WORCESTER 1, MASSACHUSETTS

HARVEY, ILLINOIS DETROIT, MICHIGAN

WHO'S WHERE

In The Front Office

Eduard Baruch, president, Heli-Coil Corp., Danbury, Conn. He succeeds **Louis R. Ripley,** who becomes board chairman. Also: **Walter Mann,** executive vice president.

R. D. Turner, president, Trans-Air, Ltd., Winnipeg.

Dr. Ralph P. Johnson and **Frederick C. Crawford,** directors, Ramo-Wooldridge Corp., Los Angeles, Calif.

Edward J. Kocis, treasurer-director, Breeze Corporations, Inc., Union, N. J. He succeeds the late **Fred G. Shupp.** Mr. Kocis also elected vice president-director, Federal Laboratories, Inc., Breeze subsidiary.

Emile L. Dumas, president-general manager, Emmett Machine and Manufacturing, Inc., Akron, Ohio.

J. D. Hungerford, assistant vice president-schedules and tariffs, **James H. Cobb,** assistant vice president-advertising, and **William G. Whitney,** assistant vice president-planning, American Airlines.

Ray W. Beck, vice president-production manager, Aero Corp., Atlanta, Ga.

Edwin M. Butler, assistant to executive vice president, Heintz Manufacturing Co., Philadelphia, Pa. Also: **John H. Thacher,** manager-quality department.

Maj. Gen. Lewis R. Parker, Headquarters, USAF, Director-Personnel Council of the Secretary of the Air Force. **Maj. Gen. William T. Hefley,** succeeds Gen. Parker as Commander-Air Materiel Force, European Area (Wiesbaden, Germany), and **Maj. Gen. George E. Price** succeeds Gen. Hefley as Commander-Sacramento Air Materiel Area.

Theodore A. Smith, executive vice president, Defense Electronic Products, and **Arthur L. Malcarney,** vice president-general manager, Commercial Electronic Products, Radio Corporation of America, New York, N. Y.

Honors and Elections

Frank J. Macklin, assistant vice president-traffic of Air Transport Association of America, was awarded the annual citation of the Airlines Traffic Association of Washington.

Col. H. S. Ellis, Commander of the 5th Air Rescue Group, received Modern Air Transport's "Air Men of Courage" citation on behalf of all commercial supplemental air carriers.

K. T. Keller, former board chairman of Chrysler Corp., received The American Rocket Society's citation for distinguished service in recognition of his contributions to rocketry as director of the guided missiles program for the Defense Department 1950-1953.

Changes

Dr. Sidney S. Browne, assistant director-research and chief analysis and evaluation division, Missile Systems Division, Lockheed Aircraft Corp., Van Nuys, Calif.

Richard J. Egger, director-sales planning, Defense Sales Division (Detroit), and **William J. Cushing,** manager, Defense Sales, Dayton District, Burroughs Corp., Detroit.

(Continued on p. 92)

INDUSTRY OBSERVER

► USAF has canceled North American Aviation's F-107 project calling for the development of an advanced F-100 series that would have been employed as a fighter-bomber. Plans called for the aircraft to be equipped with a Pratt & Whitney J75 engine and a solid radar nose. The air intakes were to have been located behind the cockpit.

► **One mission of Convair's supersonic B-58 Hustler bomber will be to act as a "mother ship" for pilotless interceptor weapons. Two of the interceptors the Hustler will work with will bear the names of "Duck" and "Goose."**

► Convair's F-102B, scheduled to fly by the end of this year with a Pratt & Whitney J75 engine, will have larger wing than the F-102A to provide for more fuel storage space and boost range capability.

► **Avro Canada's CF-105 delta wing interceptor may be ready for initial flight trials by the spring of 1957. Company also is studying a Mark VI version of its CF-100 to achieve greater altitude. One feature under consideration for the Mark VI is the use of additional small jet engines mounted on the wing tips.**

► McDonnell's F-101A Voodoo, designed for Mach 1.5 speed, already has achieved Mach 1.7 at Edwards AFB.

► **McDonnell's F-101B, long-range interceptor version of the Voodoo, will carry a radar operator. Provision for the second seat will be made by lengthening the nose of the aircraft.**

► Chance Vought is redesigning the wing-fuselage attachment of the Navy F8U fighter following the loss of two Crusaders as a result of wing failure. Until the fix is made, the aircraft will operate under a speed limitation.

► **United Air Lines is negotiating with Denver municipal authorities for the installation of a new airdock at City Airport late this fall. Airdock would position aircraft to a fixed servicing facility, include all liquid services and provisions for passenger loading and cargo handling. United Air Lines' J75-powered DC-8 transport probably will be put in service in April, 1960. Plane will be identical to UAL's J57-powered DC-8.**

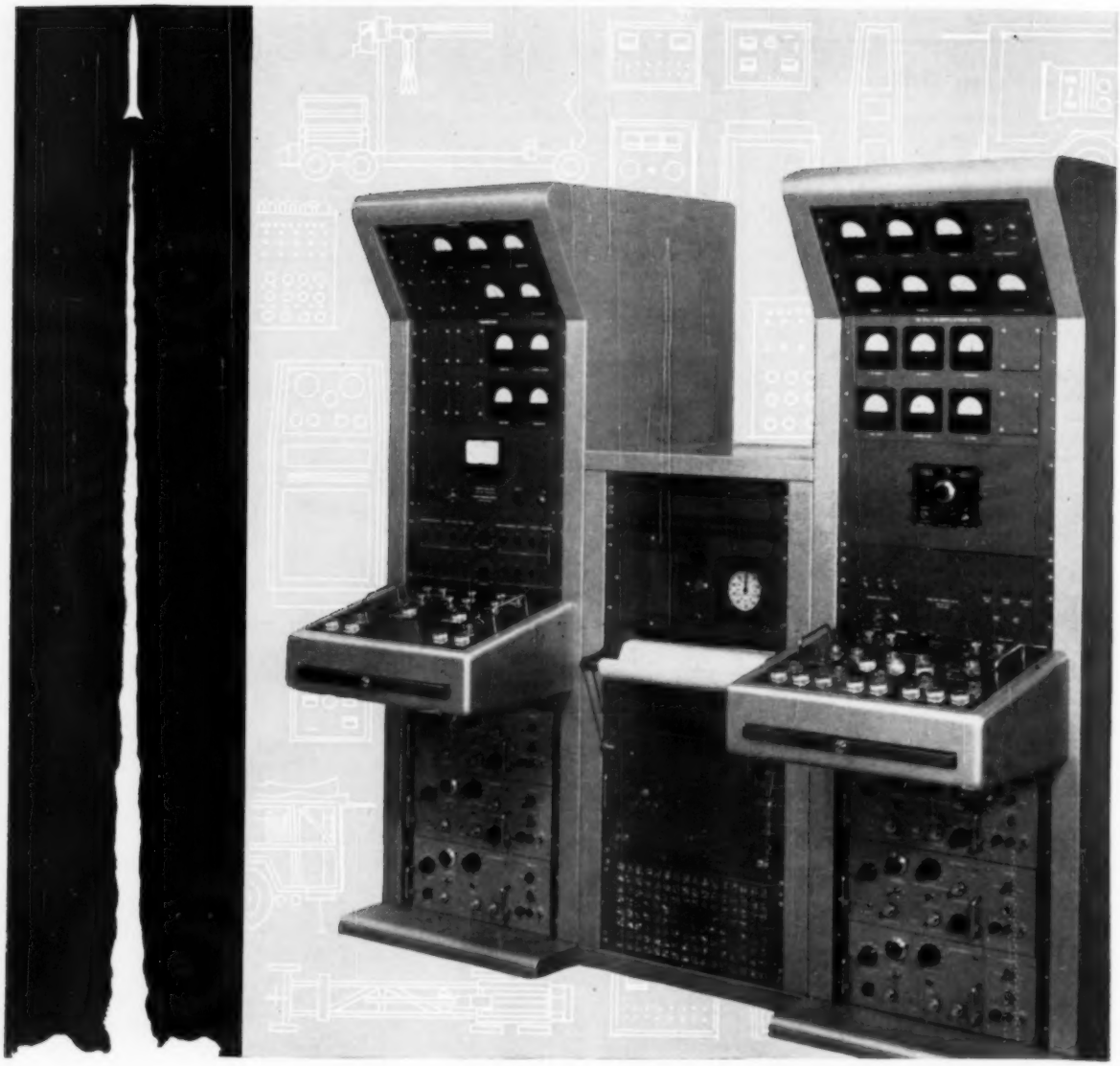
► Dorset Laboratories, Inc., of Norman, Okla., has received a $35,000 contract from the Weapons Systems Evaluation Group to conduct a study on the problems of a limited war. One other organization is making a similar study for WSEG.

► **Fuselage of Boeing B-52 droops approximately 3 in. fore and aft of the wing section when the aircraft is on the ground. As the plane becomes airborne, the fuselage levels out, and the drooping disappears.**

► Plastic models of the Lockheed F-104 now receiving wide distribution are equipped with the external engine-inlet diffusers which the Air Force went to elaborate lengths to hide during the Starfighter's recent public unveiling. As reported in AVIATION WEEK (April 23, p. 34), the diffusers, in the form of an external wedge, are used to create shock waves and get air inside the engine inlets at Mach numbers above 1.4. During the public showing of the F-104, the inlets were covered by metal shields.

► **Major USAF development project in Europe has been concerned with "dispersal vehicles." One German firm already has designed a carrier to move fighter planes into and out of unprepared fields. A mobile headquarters for C-119 units is expected to result from another study.**

► Sturdy landing characteristics of the Douglas B-66 have been demonstrated by the Tactical Air Command which has set down the medium bomber on a grass strip at Shaw AFB, S. C.



SPECIALISTS in the field of

guided missile support equipment

Associated Missile Products Corporation is devoted to the research, development and manufacture of guided missile support equipment to satisfy your requirements.

- Automatic GO NO-GO Test Equipment
- Electronic Test Equipment
- Field and Depot Handling Equipment
- Electro-Mechanical Components and Devices
- Hydraulic and Pneumatic Component and Test Equipment

- Research
- Development
- Engineering
- Production

Another AMF Product
Guided Missile Support Equipment

Ampco

ASSOCIATED MISSILE PRODUCTS CORPORATION
2709 North Garey Avenue, Pomona, California
A Subsidiary of AMERICAN MACHINE & FOUNDRY COMPANY

WASHINGTON ROUNDUP

Airpower Appraisal

The Senate Airpower Investigating Subcommittee, headed by Sen. Stuart Symington (D.-Mo.), is now ready to move into the fourth and final phase of its investigation: an appraisal of the capability of U. S. airpower to discharge its missions in the light of what is known about the strength of the Communists.

The first phase dealt with military development since World War II and included testimony by Gen. Omar Bradley, Gen. Carl Spaatz and other former leaders.

The second phase was devoted largely to lengthy testimony on Communist air strength by Allen W. Dulles, chief of the Central Intelligence Agency.

The third phase included long and detailed executive-session testimony from numerous Air Force, Navy, Army and Marine Corps commanders on various aspects of the airpower and guided-missile programs.

So far, the censored testimony of only two generals has been released, that of Gen. Curtis LeMay, commander of the Strategic Air Command, and Lt. Gen. Earle E. Partridge, commander of Continental Air Defense Command. Testimony by numerous other generals and admirals is scheduled to be released in the near future.

The subcommittee is expected to begin the fourth phase with testimony by the Air Force and Army chiefs of staff and the chief of naval operations. There also are plans to request testimony from outside top experts, including civilian scientists. The secretaries of the services and the Department of Defense are expected to be wind-up witnesses in open sessions.

Single Service Gains Adherents

The public flare-up of the bitter interservice battle over eventual control of intermediate-range ballistic missiles (AW May 28, p. 26) has stirred up fresh support for the long-dormant prescription calling for the merger of the Air Force, Army and Navy into a single service. Support of the thesis, a matter of wide discussion during the unification debates nine years ago, came from these quarters last week:

Thomas K. Finletter, former Air Force Secretary and now political adviser to presidential hopeful Adlai E. Stevenson, proposed a single service to give the U. S. the "defensive shield" it needs. The current rivalries over weapons and missions, Finletter said, signifies that the American people are "not getting their money's worth out of their tax dollar."

Sen. Henry M. Jackson (D.-Wash.) declared that the current fast pace of technological development and interservice rivalry made the merger "imperative."

Sen. Allen J. Ellender (D.-La.) urged during Senate Military Appropriation Subcommittee hearings that the single-service plan be adopted to eliminate military "waste" and "duplication."

New Profits Investigation?

Senate Democrats now hope to put the Eisenhower Administration on the spot in the matter of profiteering on defense contracts.

Oregon's Sen. Richard Neuberger touched off the move with a speech on the Senate floor calling for the President to appoint a special commission to report on industry profits from military business. Neuberger pointed out that a presidential commission, headed by Gen. Omar Bradley, already has reviewed veterans benefits and declared in its report: "Military service in time of war or peace is an obligation of citizenship and should not to be considered inherently a basis for future government benefits . . ."

Commenting on the report, Neuberger declared:

"If a presidential commission can apply the standard of obligation of citizenship to those called upon to risk their lives for our country during a military emergency, what about the obligations of those who manufacture the armaments which those soldiers and sailors must take into battle?"

He said another commission should "see whether our armed forces are being furnished with weapons and material, as well as with servicemen, as an obligation of citizenship, and without special economic reward." He predicted that such a study "would show that never before have there been such vast profits from the production of weapons and other materiel for the armed services."

Marshal Zhigarev to U. S.?

President Eisenhower says Marshal Zhigarev, the Russian air chief, is welcome to visit the U. S. any time he wants. The President said he decided to have Gen. Nathan F. Twining, USAF Chief of Staff, accept an invitation to visit Moscow knowing that "I might be expected to extend exactly the same courtesies to one of their people that they extended to ours. I will do exactly that, the same courtesies, on the same conditions, and conducted the same way."

Eisenhower said that, if General Twining's Russian counterpart indicates he would like to visit the U. S., an invitation will be extended on a reciprocal basis. This apparently ruled out a visit from Marshal Zhukov, since he is the Soviet opposite of Defense Secretary Charles E. Wilson, and the President said that an invitation to Zhukov would not be warranted unless Wilson got an invitation to Moscow.

Lowen Confirmed

The Senate last week confirmed the nomination of Charles J. Lowen as administrator of the Civil Aeronautics Administration despite a loud "No" from South Carolina Sen. Thomas Wofford. Earlier, Wofford had opposed the nomination when it was acted upon by the Senate Commerce Committee because of the CAA's position that federal funds cannot be granted for facilities where racial segregation is practiced. The senator said that Lowen, in implementing the policy, had "exceeded authority granted or implied by Congress."

Sen. Smith on Warpath

Sen. Margaret Chase Smith (R.-Me.), after taking a slap at "big airlines" (see p. 38), went on last week to charge that there is a "growing trend" among cities to receive federal money for airports and then to "push the Air Force Reserve off." The Senator cited Chicago's O'Hare Field and the Greater Pittsburgh Airport as her "two major examples." At O'Hare, she said, $32 million has been spent by the government for military facilities, and now the "Air Force has been given notice to get out." Pittsburgh Airport, Sen. Smith said, has told the Air National Guard and the Navy to "get out" by June 30.

—Washington staff

Single Defense for U.S., Canada Proposed

CONAD chief tells Senate group that Alaska, Northeast, Canadian Air Commands all run own defenses.

By Katherine Johnsen

Washington—Initial steps are being made in an effort to bring the far-flung, sometimes loosely-knitted U.S. and Canadian continental defense systems under a single operational command.

The need and planning for such a unified system was outlined by Lt. Gen. Earle E. Partridge, commander of the Continental Air Defense Command, in testimony released last week by the Senate Airpower Investigating Subcommittee.

Single control for the continental U. S. was accomplished in September 1954, with the establishment of Continental Air Defense Command (CONAD), including Army and Navy, as well as Air Force air defense elements.

Single-System Plan

Gen. Partridge pointed out that, although "there are already very close tie-ins," the Alaska Command (under Lt. Gen. Joseph Atkinson), the Northeast Command (under Lt. Gen. Glenn O. Barcus) and the Canadian Air Command all "run their own air defense" systems.

He added:

"It is obvious to me working at the business that we have to tie this whole system together operationally by some manner or means.

"There are plans under way at the present time to centralize at Colorado Springs (CONAD headquarters) the operational control of all this system."

However, under the plans outlined by Partridge, the Atlantic and Pacific naval air defense elements, headed by Adm. Jerauld Wright, commander in chief of the U.S. Atlantic Fleet, and Adm. Felix Stump, commander in chief of the Pacific Fleet, would continue to operate under their present commands.

Effectiveness Increasing

Although Gen. Partridge testified that the present air defense system is "not completely adequate," he emphasized that its effectiveness "is increasing by leaps and bounds."

A portion of Partridge's testimony released earlier by the subcommittee highlighted the inability of CONAD's present interceptors—F-86Ds, F-89s, and F-94Cs—to attain the altitude of Russia's Bison intercontinental jet bomber (AW June 4, p. 30).

Gen. Partridge, when faced with the observation by subcommittee chairman Sen. Stuart Symington (D.-Mo.) that "the operational altitude of enemy bombers is considerably higher than the fighters that you have," replied:

"That is the extreme statement of it.

"I would say that a few enemy bombers presently can operate higher than our fighters if they come in under certain conditions—one way, light bomb load, etc."

Defense-System Remedies

Partridge outlined two immediate steps that are being taken to meet the situation:

- **Introduction of the Falcon** air-to-air missile. During this month, he said, F-89H aircraft will be equipped with Falcons to add to their defense capability at high altitudes. "When we introduce the Falcon we begin to pick up additional altitude capability that was based solely on our ability to shoot uphill."
- **Introduction of the F-102A.** The first F-102 unit is now being formed and by the end of the year there will be "a number of operational aircraft" in CONAD.

Later models of the F-102 will carry Falcons.

Gen. Partridge gave this picture of air defense:

- **During 1957,** 1958 and early 1959, "We find ourselves in not too good shape with regard to our high-altitude and our low-altitude air defense." Present defenses are "deficient in early warning time, in radar coverage and in performance of present fighters."
- **The programmed build-up** of air defense, however, will remedy these deficiencies to a large degree and "make it possible for us to work effectively against any hostile aircraft which may come into the system with the characteristics of the weapons which the Russians appear to be developing. This is true through the manned bomber. . . . We see our way reasonably clear to the solution of the problem of building an effective air defense against any type of manned bomber which we now see on the horizon."

But, even with this build-up, he warned, "We must be prepared to accept major damage, severe damage, if the enemy does attack."

- **"Where we forecast real difficulty** is with the intercontinental ballistic missile." No solution in the way of an anti-ICBM defense is on the horizon, Partridge said, "but our scientists say it can be done and that we should be getting along with it.

"My point of view is that the threat of Soviet attack by ICBM is so frightening that we cannot afford to put less effort into the defense than we put into the offense. . . .

"In principle we have one (solution) according to the scientists (an anti-missile missile system), but it has not yet been translated into any hardware, and until we can prove out the components and figure out a way to make the thing work operationally, I do not rest very easily."

Gen. Partridge reported that the air defense system of the Soviet Union employs 550,000 persons as compared with the 135,000 engaged in the U.S. system.

He listed the requirements needed to improve the air defense system in this order: technical personnel, base facilities—particularly for SAGE and distant early warning network—research and development, aircraft.

Better-Engine Need

The general declared that "it is mandatory that we bring out some new engines which will permit us to fly our fighters at a very much higher speed than is presently possible and cruise at higher altitude."

He said that even the F-104, latest high-performance aircraft scheduled for CONAD, still does not meet the requirements.

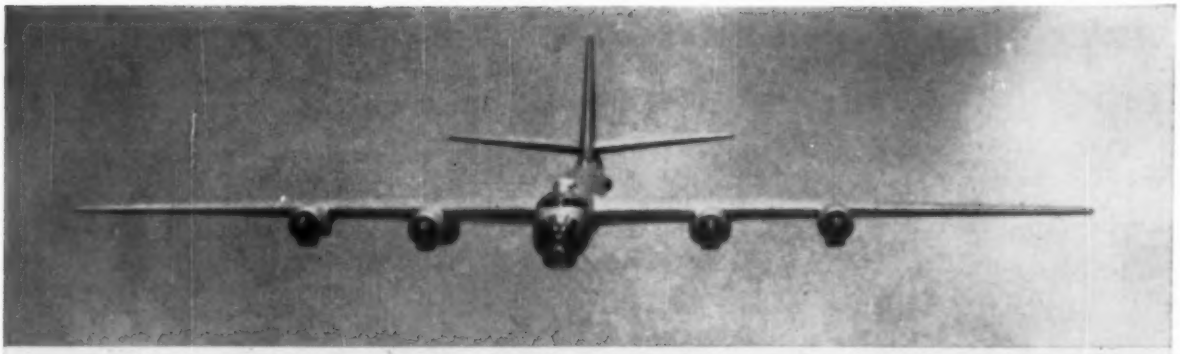
Gen. Partridge told the subcommittee an aircraft engine should be developed which would give an altitude of 80,000 ft. "or more" and provide a speed of Mach 3.

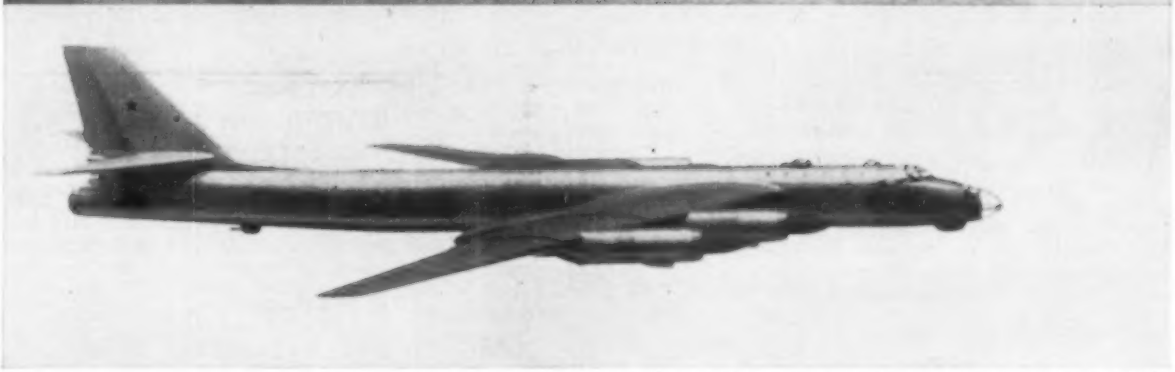
"A great deal of research is going to have to be done," he commented, "not only in the field of the engine itself, but in bringing along an airframe and components to withstand the terrific heat which will be encountered."

Attack From Air

Other points made during the testimony:

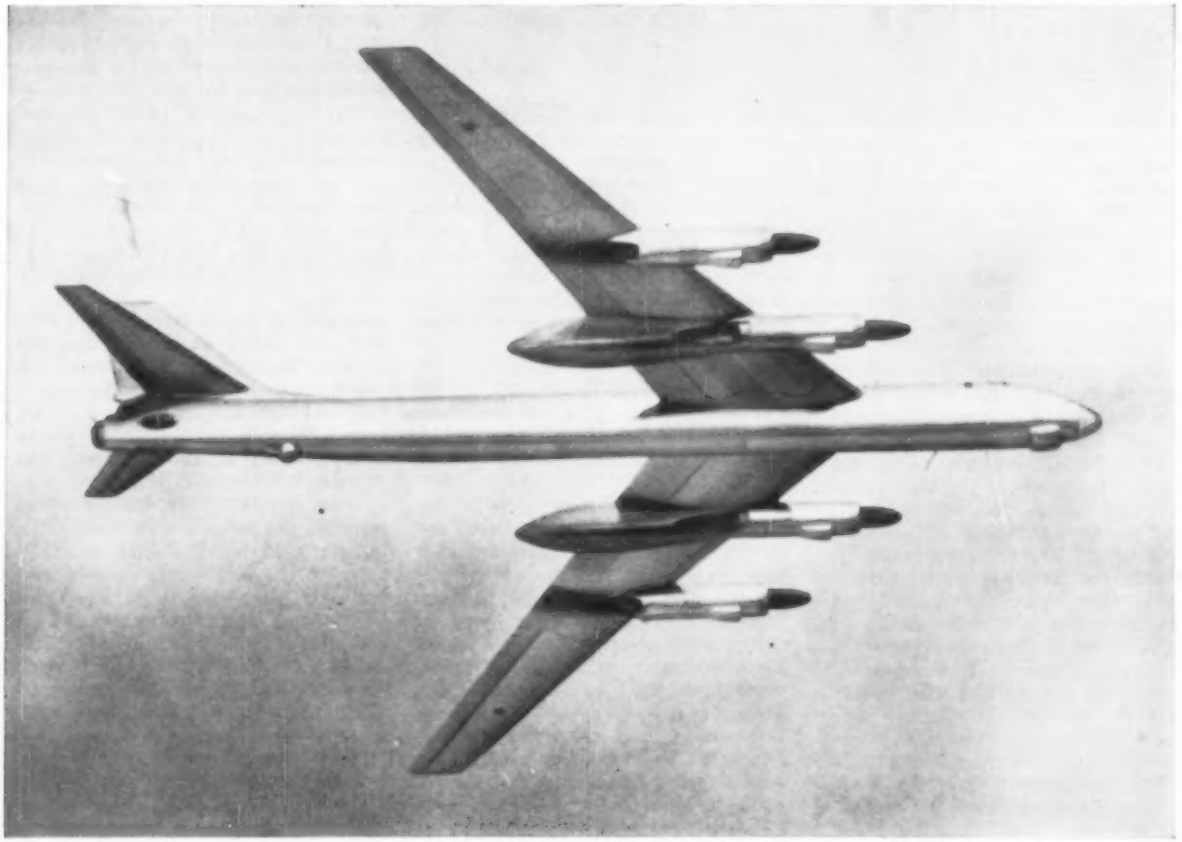
- **Since it would be difficult** for the Soviets to put large numbers of missile-firing submarines along the U.S. coastline without detection, "We think they will make their initial attack based on aircraft." However, "A Soviet submarine attack would pose a great threat after the initial attack, because some 30% of the profitable targets in the U. S. lie within 150 miles of the shores."
- **At present, approximately** 35 aircraft daily, flying within the continental limits of U. S., are not properly identified.





Three Views of Russian Bear Long-Range Turboprop Bomber

Russian Bear can strike any target in the U. S. using a single in-flight refueling, says USAF. Bear uses four turboprop engines, has obsolescent fire-control system. Some observers believe Bear to be useable as a tanker for aerial refueling of Bison, Russian strategic jet bomber.



Joint Committee Action Indicates Renegotiation Policy Extension

Washington—The extension of the government's renegotiation policy for at least another two years seemed virtually assured last week upon the recommendation of the powerful Joint Committee on Internal Revenue Taxation.

The joint committee is headed by Sen. Harry F. Byrd (D.-Va.), chairman of the Senate Finance Committee. The vice chairman is Rep. Jere Cooper (D.-Tenn.), chairman of the House Ways and Means Committee.

The original act setting up an independent Renegotiation Board to review the profits on government contracts let by the Department of Defense and 20 other government agencies is due to expire Dec. 31, 1956. The joint committee called for extension to Jan. 1, 1959. Other recommendations by the committee were:

Committee Recommendations

• **That "net worth" continue** to be a factor in the determination of profits. (The aircraft industry, with a comparatively small capital investment as compared with sales volume, has protested that the Renegotiation Board has put too much emphasis on the relation of profits to net worth.)

• **That annual sales volumes** of $1 million or less be exempted from renegotiation. The present floor of $500,000, the committee said, "prevents the board from concentrating on the large cases where the amounts involved justify the complicated procedure." (From 1951 through 1955, refunds in the sales categories from $500,000 to $1 million amounted to $32 million as compared with recaptures of $326 million from firms with over $1 million annual business.)

• **That renegotiation** be applicable only to the contracts of the military services, Atomic Energy Commission, General Services Administration and the Maritime Commission. This would exempt the contracts of the National Advisory Committee for Aeronautics and the Civil Aeronautics Administration, now subject to renegotiation.

• **That the provision** for carry-over of losses (for application against future profits) be extended from one to two years. The committee rejected proposals for a carry-back of losses. The committee report declared that "a provision for the allowance of subsequent losses would only produce delay and administrative difficulties."

• **That the present procedure** for appealing Renegotiation Board decisions whereby the U. S. Tax Court is the final arbiter on the question of excessive profits should not be changed. (Legislation has been introduced providing for appeals of profits decisions from the Tax Court to the Courts of Appeal and the Supreme Court.)

• **That subcontracts** made under contracts with tax-exempt organizations should be "automatically" exempted from renegotiation.

• **That exemption** from renegotiation of contracts performed abroad by foreign contractors should be "mandatory," rather than "permissive" as it is now. (This would not apply to foreign subsidiaries of domestic corporations.)

The committee stipulated that "renegotiation should not become a permanent part of the law. We are now, however, in a period of semi-mobilization, with defense procurement running as high as $17 billion a year. The emphasis in the current defense program on rapid technological improvement in weapons makes pricing difficult. For these reasons a temporary extension of renegotiation is necessary."

With expiration of renegotiation, the old Vinson-Trammell Act, setting a 12% profit ceiling on military aircraft business, would automatically become effective again. It was supplanted by the renegotiation procedure during World War II.

In view of this, the joint committee called for a congressional review of "the entire profit limitation area" before renegotiation is terminated. The review, the committee said, should determine whether the provisions of Vinson-Trammell are "adequate, necessary or workable" and consider "the scope and effect of price redetermination provisions incorporated in procurement contracts."

USAF Endorsement

The committee's recommendations were "strongly" endorsed by the Air Force. USAF Secretary Donald Quarles explained:

"While we have achieved major improvements in our pricing policies and contracting techniques, there nevertheless remains an area in which only renegotiation can be effective to assure that the U.S. gets what it needs for defense without paying excessive profits. In the changing technology of the defense effort, new equipment becomes more complex and past production and cost experience is not necessarily satisfactory for forecasting and avoiding unconscionable profits.

"This factor has increased dramatically in importance with the new urgency which has centered on the guided-missile and supersonic-aircraft programs. The problem is further complicated by the numerous changes and improvements which are necessarily introduced into production to achieve better performance, safety in flight, and producibility.

"Under such circumstances price redetermination and other pricing techniques cannot be considered a complete solution. Other factors also preclude close pricing to the extent desired. These arise principally in situations where the government is unable to obtain the benefits accruing from extensive competition because of limited sources or proprietary situations."

Thompson Operates Navy Jet Parts Lab

Cleveland—The first full scale and completely equipped laboratory for testing component parts for jet engines was placed in operation last week by the owner, Navy Bureau of Aeronautics, and operator, Thompson Products at Perry, Ohio. The laboratory is on a 90-acre tract 25 mi. from Cleveland.

It was constructed and equipped at a cost of about $1.4 million. Rear Admiral J. N. Murphy, deputy chief of procurement, said at the dedication the facility is essential to support component development on a mating time schedule with the engine builder without disrupting major engine development and testing work.

The laboratory has two test cells—one still to be completely equipped—designed for turbojet and turboprop engine operation under sea level static conditions and capable of accepting engines with 40,000 lb. thrust ratings. Test cell air flow of 1,100 lb. per sec. with 450 lb. of it from the engine is possible.

A spin pit, 7 ft. in diameter and 7 ft. deep, will take a wheel for testing up to 50 in. in diameter and by removing the furnace a 70-in. diameter wheel can be tested. Chamber pressure reaches to 200 microns, but can be brought down to 100 microns. The chamber is heated to 2,500F by electric glow bar furnace. It is a non-destructive type of spin pit and will operate the test piece, depending on size, at 20,000 rpm., with speeds up to 25,000 rpm. available.

The test engine control room is equipped with digital logger—100 channel, X-Y plotter 12 channel, high speed recorder 6 channel, gas chromatography plus elaborate fuel and fire control systems.

Electric power for the laboratory is provided through a 1,100 kva. substation with diesel generator for emergency power.

F8U Takes Off, Lands Wing High But Nose Low

Variable incidence wing of Chance Vought Crusader hinges at back, raises at front to give angle of attack for flight while fuselage remains almost parallel to ground. Two-position wing permits use of short, weight-saving gear that makes all compartments of plane readily accessible for servicing. It also permits low drag, smoothly faired cockpit without sacrifice of good visibility. F8U is first production aircraft to use the wing, though some X models have had it. Two crashes have been blamed on wing failure, however, and wing-fuselage attachment is being redesigned. Speed now is restricted.

Private Flying Segments to Work Together on Ground, Air Problems

New York—All major segments of general aviation have reached agreement on the need for a single authoritative voice in presenting their case to government advisers developing a program to ease the nation's bottlenecks in airspace, air traffic and the critical shortage of ground facilities as it affects military, airline and private flying.

At an historic meeting at National Business Aircraft Assn.'s Washington, D. C., offices last Monday, representatives of all phases of civil aviation excepting the airlines named an executive committee of three top aviation and industry figures to work with Edward P. Curtis, President Eisenhower's special assistant for aviation facilities planning.

The three, who will supervise presentation of a report charting general aviation developments and requirements over the next 10 to 20 years, will call on Curtis, probably at the end of this month for a briefing on the type of information he desires for planning his various recommendations to the President.

The meeting marked the first time that such a large and diverse group of general aviation interests have sat down at one table and reached unanimity so quickly, underlining the private flyers' fears that they will come out a poor last in any decision relating to integrated aviation facilities. Up to now general aviation spokesmen have made individual although similar presentations on critical problems affecting private and business flyers. Also significant is the backing of Cessna Aircraft and Aero Engineering & Design on the general aviation facilities planning proposal, indicating that the industry realizes the chips are down and that an all-out effort is required to ensure that general aviation's case is fully weighed.

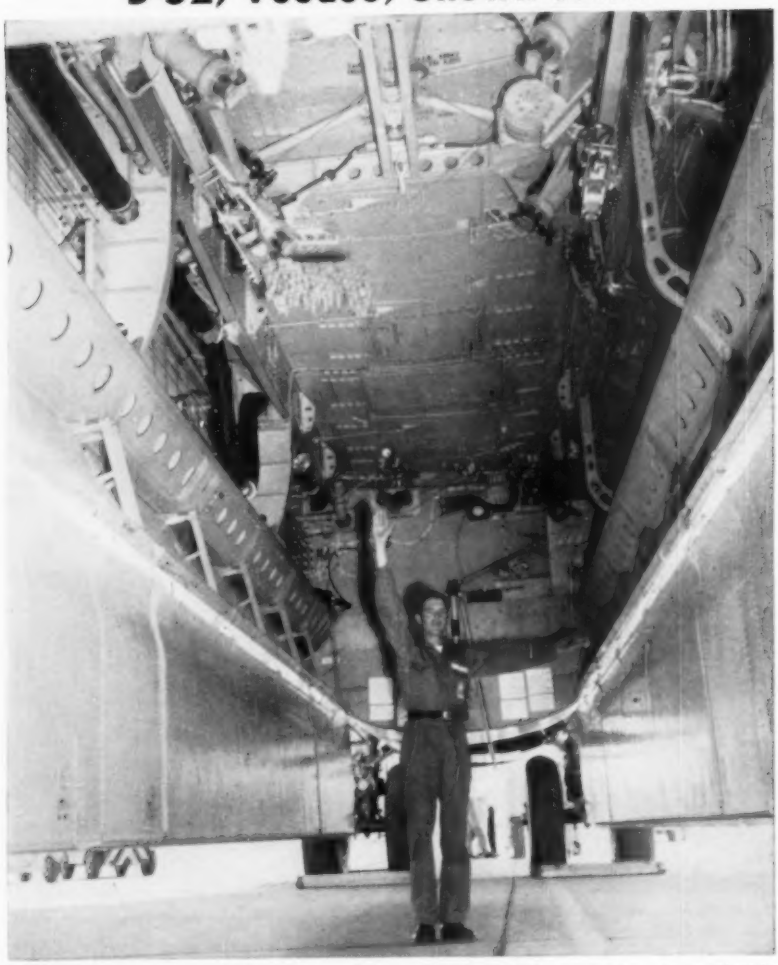
The executive committee members: Dwane L. Wallace, president, Cessna Aircraft Co., Wichita, Kans., Dwight P. Joyce, president, The Glidden Co., Cleveland, Ohio and Dr. Leslie A. Bryan, director The Institute of Aviation, University of Illinois, Urbana, Ill.

Represented at the initial meeting: American Association of Airport executives, Aircraft Distributors & Manufacturers Assn., Aircraft Owners & Pilots Assn., National Association of State Aviation Officials, National Aviation Trades Assn., National Business Aircraft Assn., National Flying Farmers Assn., National Pilots Assn. and the Utility Airplane Council of the Aircraft Industries Assn.

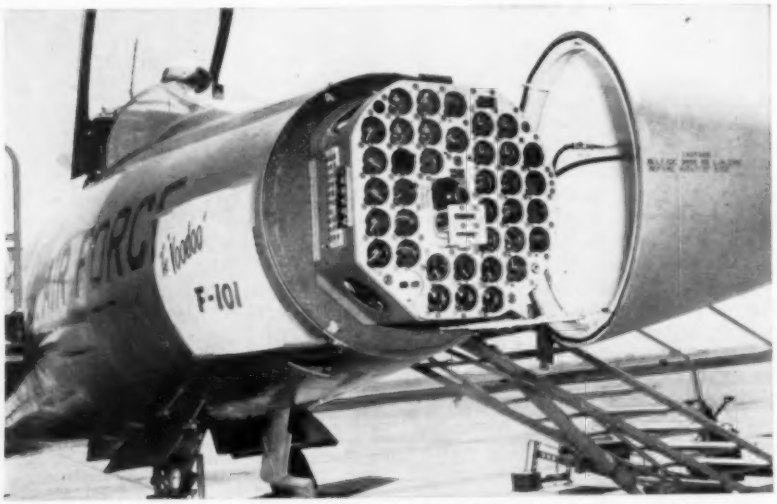
The representatives developed a tentative organization chart for the general aviation facilities planning group. Under the executive committee will be a working committee comprising representatives of participating organizations, and these subcommittees: economic, airports, technical and policy and administration.

The planning group will also set

B-52, Voodoo, Shown AWA



SIZE of B-52 bomb bay which can be used for nuclear bombs, in comparison shot with 6-ft. airman standing in center with arms outstretched.



CLOSEUP of F-101A nose test instrumentation grouped in a package mount. Movie camera in center is aimed at a mirror in the hinged section, photographs readings on instruments reflected in the mirror. Plane is from the Edwards AFB Flight Test Center.

up a liaison with military and airlines for exchange of information and views on current problems.

Major immediate task is to compile data needed for incorporation into a brief to be presented to Curtis regarding general aviation's economic stake; its capabilities, including services for mobilization in event of an emergency, and airspace and airport requirements. The planning group will retain a private research organization familiar with aviation to collect data to be supplemented with material supplied by the membership. A director representing the planning group will coordinate all phases of the research project.

It is expected that the final report will be submitted to Curtis by October. Curtis' office has let three contracts totaling $30,000 with private research firms to make studies of what can be expected in general aviation in the future.

Douglas Seeks Site To Test Full Missile

Santa Monica, Calif.—Douglas Aircraft Co. is negotiating with Aerojet General Corp. to lease a 1,715 acre part of Aerojet's rocket engine test facility near Sacramento. Douglas wants the site for a test facility for complete missiles, and the Aerojet location is in sparsely settled country, yet not too far from major southland plants. It also is close to Mather Field, a major AMC installation.

No agreement with Aerojet has yet been signed. F. W. Conant, Douglas senior vice president, said the contract would be a lease agreement, with option to buy.

The site would have a small machine shop for equipment maintenance and a small assembly building for missile assembly, as well as the structures for missile tests which include engine firings. No actual launchings would be accomplished. The initial work force would be about 200 people.

Contract Awarded for Development of Gatwick

London—A major step toward developing Gatwick Airport as an alternative and complement to London Airport has been taken with the awarding of a $5.6 million construction contract.

The contract was awarded to Sir Alfred McAlpine & Son Ltd., of Cheshire, for the construction of a runway, taxiways, ramps, drainage and auxiliary engineering works. The contract is part of the initial building program which has been estimated at $16.8 million. The airport opening is planned for the spring of 1958.

USAF Adopting New Approach To Interservice Rivalry: Ignore It

San Francisco—The U.S. Air Force is adopting a dignified new approach to inter-service rivalry. It's going to ignore it. From now on the USAF will let the Army and the Navy sling mud and start rows.

It is determined not to participate in such activity.

First examples of USAF's new look were the speeches of its top representatives at the Aviation Writers' Assn. convention. Its six spokesmen (compared with two for the Navy and one for the Army) stressed the Air Force's strength, its dominant role as a deterrent to war in the past, present and future, and its requirements for greater strength.

The sister services were mentioned, if at all, only in a patronizing manner.

The tone for the Air Force front is being formalized in a letter being sent by its chief of staff, General Nathan F. Twining, to all major commanders. It says, in part, as quoted by Air Force Secretary Donald Quarles: "The Air Force is a very important member of the defense team. While it is proper to bring this out, we should at the same time strengthen the team as a whole by acknowledging the competence of the other members. . . . The Air Force objective in dealing with the public is to help build confidence not merely in the Air Force but in the entire national security program. Let us go about this task with pride in the positive achievements of the Air Force. Negative material will only bring negative results."

Careful Consideration

Although drafted earlier, the letter was not processed for distribution until after Twining discovered that Quarles had quoted him June 3 at Grinnell College.

The attitude being taken by the Air Force follows a careful review of its present position and a calculation of eventual public reaction. Called in for consultation were some of the people now in civilian life who helped mastermind the Air Force strategy during the B-36 row started by the Navy in the late 1940s.

USAF has decided that it is the dominant force in the U.S. defense establishment and will continue to be. If and when there is a re-evaluation of missions and defense roles, it believes that the decisions will be made in its favor; that it won't lose and probably will gain further prominence.

The case for airpower, its leaders believe, is irrefutable and all sensible men will accept this premise. They even go so far as to say that complete unification is not too far off.

General Thomas D. White, USAF vice chief of staff, told AWA:

". . . I believe that our military services will move toward more complete unification. We need a military organization that will help us all to be free of conflicting service loyalties and confusing influences.

"With the passing of time, the roles and missions of all the services seem to overlap more and more. Conceivably, if these trends continue the day would come when, for all practical purposes, all three services would have the same weapons, the same capabilities and limitations, and all attempting to do the same jobs. . . . Perhaps we certainly would find it advisable to standardize and streamline the organization.

"As proud as we are of the United States Air Force, we will certainly be behind any actions which will reduce the chances for wasteful duplication and controversy. . . ."

Maintaining Peace

Earlier, White stressed the role of airpower in maintaining peace for the past decade and the need for military strength-in-being that could win a war very quickly.

He made only one veiled but sharply pointed crack at the Army. Referring to the crime for which Daedalus was imprisoned, White remarked: "He murdered his nephew, who was named *Talos*."

Gen. Curtis E. LeMay, commander of the Strategic Air Command, outlined SAC's great manpower requirements.

He says better pay scales, housing, medical care for dependents, educational facilities and exchange and commissary privileges are mandatory if SAC is to keep enough experienced personnel to effectively operate its bomber forces.

Like General White, he stressed SAC's positive role in the U.S. defense establishment: "The resulting offensive power (of SAC) will confront our potential enemies with the certainty of destruction if they should risk an attack on this country."

Twin SAC Mission

"Given such a force, there is solid reason to believe that such an attack will never be made. This is the twin mission of the Strategic Air Command: to deter aggression by maintaining American offensive air might at such a level that no enemy will risk its blows, or if that should fail, to use that force to bring an early decision in the airpower battle."

USAF is not even allowing the Army to run away with the mission of periphery wars, like the Korean War. Maj. Gen. E. J. Timberlake, commander of the Ninth Air Force who substituted for Gen. O. P. Weyland, head of the Tactical Air Command, discussed the theater air force or tactical air role in local conflicts.

"The build-up of theater-type air forces during recent years has been gratifying both from a technical and a combat standpoint," Timberlake said. "Most important has been the marriage of the atomic bomb with the single-seat jet fighter as well as with the light bombardment plane. Of no lesser significance is the tactical guided missile."

Mobile Strike Forces

Inflight refueling and miniaturization of support equipment now enables TAC to dispatch fighter and light bomber aircraft to any point in the world within a day.

Timberlake said such mobile atomic strike forces serve a two-fold purpose because they:

- **Make deterrent forces** readily available to our allies.
- **Provide decisive strike** forces to control the air and to support the surface forces of our allies.

The TAC role stresses the utilization of atomic weapons, modern equipment and limited numbers of highly skilled American technicians to help defend our allies overseas, rather than depending upon American infantry manpower.

The Air Force is confident that its position is unshakeable and will be the rock upon which Army and Navy assaults eventually will founder.

Kaman Offers Civil Version of HOK-1

An export version of the HOK-1 helicopter designated the K-600 is being made available by Kaman Aircraft Corp., Bloomfield, Conn. As a transport, the K-600 will seat a crew of two side-by-side and three passengers as a cargo helicopter, it will carry 2,000 lb. slung under the fuselage with full fuel load. HOK-1 production up to recently has been only for the Navy.

The company is offering the K-600 to friendly foreign military services. It has not been released for civil use.

Basic K-600 data: powerplant, one 600-hp. P&W R1340-48; weight empty, 4,040 lb.; maximum gross, 6,800 lb.; service ceiling, 17,000-18,000 ft.; maximum fuel capacity, 100 gal.; top speed, 90 kts.

Logistics Pinch Turns C-123 to Cargo

By Claude Witze

Dreux, France—USAF's C-123 assault transport, designed and put into operation to fly Army infantrymen into or near their combat positions, will operate primarily as a cargo carrier for its operations in Europe.

The reason is simple: The USAF has a fantastic Air Logistics System serving 114 airfields in 34 countries, and it lacks the proper equipment to carry out this transport assignment for the North Atlantic Treaty Organization powers.

To alleviate this, the C-123-equipped 309th Troop Carrier Group has arrived here from Ardmore, Okla., as a replacement and supplement for the earlier C-119 units on cargo runs. The group's C-123s will haul hardware and personnel around Free Europe, North Africa and parts of the Near East.

Because of these logistic demands, certain to last over a long period, training now under way at Ardmore AFB (AW April 9, p. 28), probably should be modified to place more emphasis upon the C-123's cargo-carrying potential.

Logistics Mission

The first flight of 10 C-123s from the U.S., advance contingent of 52 aircraft on their way to this base 60 miles south of Paris, received an assignment on the logistics run within an hour of their arrival.

Upon joining the 60th Troop Carrier Wing of the 322nd Air Division, pilots and crew members were told to have four planes ready the next day for an engine-hauling mission out of Chateauroux. Five more planes were required in 48 hours. The 309th met the demand.

Col. Clyde Box, commander of the 322nd, emphasized that the 309th may get an opportunity to practice assault transport missions, but he made it equally clear that the Army has not yet requested him to perform such a mission. The reason could be that the 322nd never had an assault transport until the first C-123s arrived. On the other hand, the 322nd's major mission is air logistics; it is short of equipment, and the new plane can carry hardware.

Col. Box said his unit, composed of three troop carrier wings and two air transport squadrons, has roughly only half the transport capability that it needs.

He is eager to get his own Douglas C-124 transports and the newer Lockheed C-130 turboprop aircraft.

The 322nd has just reached its second birthday. In those two years, air logistics missions have eaten up 34-million miles of flying over an air line with 16,000 miles of routes. They have flown 50-million passenger-miles and carried more than 150 million pounds of equipment. Some 30,000 paratroopers, representing other NATO nations besides the U.S. and their equipment have been dropped.

Air Logistics Economy

There is great economy in this air logistics system. This is best realized by Lt. Gen. William H. Tunner, USAF commander in Europe, who estimates that more than $500 million has been saved in the 322nd's two-year history.

The saving is almost entirely in the value of merchandise removed from the slow-moving surface pipeline.

At Dreux, the 309th is attached to the 60th Troop Carrier Wing. The wing commander, Col. Randolph E. Churchill, says the 123s will be called upon to fly 2,400 hours a month on logistics runs. Like Col. Box, however, he says assault-type training such as the unit had in Oklahoma can be continued if the Army decides to join in.

Basically, the 309th's present lack of assault training in Europe stems from the USAF's critical shortage of the right kind of airplanes to do the logistics job in the best possible way.

Rather than having to use the C-123s, Col. Churchill would prefer an adequate number of C-130 turboprop transports.

The first ones to Europe are scheduled for his wing, but they are not expected until 1958.

Why a Mission Change?

There are these other factors in the situation:

- **Maintenance time** and costs on the C-119s now in use are objectionably high. Phase IV tests carried out in Europe by a single C-123 indicate a big improvement. By phasing in the newer Fairchild aircraft, maintenance time per flying hour will be cut at least in half and possibly by as much as 75%.
- **Top control of the C-123s** now is held by Gen. Tunner. His prime responsibility and interest at this time is in logistics as our fast-growing string of bases become more operational.
- **Despite the fact** that the USAF set up the 309th to perform an air mission for the U.S. Army, there is little evidence of Army enthusiasm for utilizing it in combat assault training. This may result in part from a lack of unanimity within the Army itself, where there are pro- and anti-aviation officers. The pro-aviation officers have their own future plans, not yet fully disclosed. They undoubtedly call for further integration of air units, aimed at centralized control under Army commanders.
- **There are relatively few** American foot-soldiers in Europe, where the emphasis has been on paratroopers, the genuine airborne GIs with special training. One of the 309th's specialities is moving the GI without paratroop training or expensive special equipment.
- **In addition** to requiring less maintenance, the C-123 is expected to be a more reliable aircraft than the C-119, easier to load and unload. Its low tail ramp will eliminate the need for elaborate ground equipment, permit unloading of most heavy units in less than five minutes.
- **The C-123** so far has a perfect safety record. In well over 14,000 hours of flying, the 309th never has recorded an accident.

309th's Future

There are substantial reasons for speculating that the C-123 crews will find themselves dropping paratroopers and heavy field equipment instead of performing the newly-perfected assault transport role. As the C-119 is phased out, training missions are expected with the airborne. Static lines can be installed in the C-123, but their use in various tests has not been entirely satisfactory.

As part of the 60th Wing, the C-123s now have tactical support as a prime mission. In addition to air logistical operations, this must include airborne assault, aerial resupply and medical evacuation. The 309th has had some experience in the latter field, particularly during last year's Exercise Sagebrush in Louisiana, but the aircraft admittedly is noisy and should be insulated for this kind of work.

In July, the 309th's C-123s are scheduled to receive their first European workout with the Army. But it is an air transportability exercise, not an assault transport assignment. Working with three combat teams of the 10th Infantry Division, 30 of the aircraft will work for six days somewhere in Germany. Each plane will fly 30 sorties a day. On the total of 540 sorties they will haul 2,160 tons of equipment and 11,800 soldiers.

None of these sorties will be into unprepared fields of the type used by the 309th in its training program at home. The 322nd is enthusiastic about the prospects on this exercise because of its experience in the past two months with a single C-123 sent here in advance for evaluation. In an 11-day

test, that aircraft moved 118,000 lb. of military equipment.

A number of the officers and men of the 309th obviously are disappointed in the change of their assignment, although many of them admit they had anticipated it.

Some feel, for example, that should war break out some time in the future they will have lost their proficiency in assault transport operations.

The change, however, is forced upon them by the USAF's lack of transport planes to meet the NATO requirement to which the U.S. is pledged, and top-level Air Force officers feel that the crews will be able to regain their proficiency with a minimum of "brushing up."

Air Force, AEC, Navy Plan Weapons Range

Washington—The Air Force, Atomic Energy Commission and the Navy are planning to establish a joint weapons testing range near Albuquerque, N. M.

An Air Force spokesman, explaining the need for the facility which probably will adjoin existing test ranges, said the "increased versatility of nuclear weapons has imposed testing requirements which make it desirable to have a joint range." The requirement, he added, "is from the ballistics point of view."

Disclosure of the need for such a range was made before the House Interior Committee. Brig. Gen. Alfred D. Starbird, director of military application for the AEC, told the committee that January 1959, appears to be the earliest that such a range can be available.

In the meantime, Gen. Starbird said, the AEC plans to use part of the two-million acres which the Air Force recently released at its Tonopah, Nev., range.

He said AEC will begin tests there in October.

The General added that the Air Force would need a range 100 miles long to deliver bomb shapes to an impact area. Aircraft to be used in the tests are based at Albuquerque. The range cannot be located over water, Gen. Starbird said, because of the problem of locating the various test instruments.

An Air Force spokesman said it has been determined that the range can be a joint facility but that questions still exist as to its exact location and which agency will operate it.

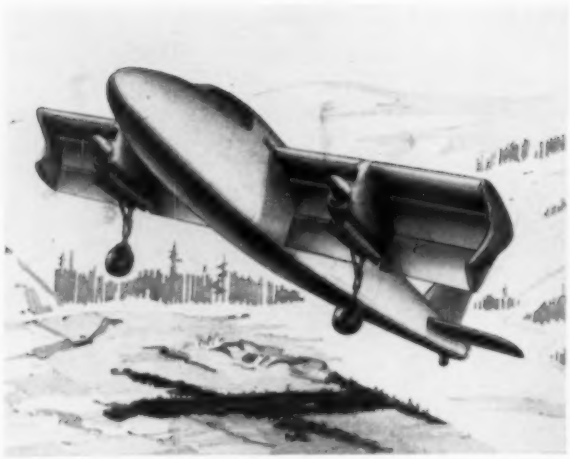
It is known that the Air Force Armament Center of the Air Research and Development Command needs more extensive range facilities for bomb shape testing and the collection of ballistics data.

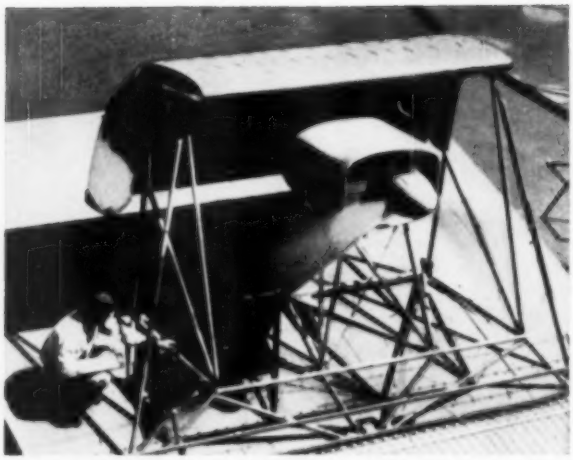
New Hunter Mk. 6

HUNTER Mk. 6 soon to enter RAF service. Note size of cartridge ejection blisters

BRITISH maintain Mk. 6 attained supersonic speeds during level run at Zurich air show.

MANUFACTURER is Hawker Aircraft Ltd. Note British use of camouflage paint.





ARTIST draws vertiplane (left) landing with power added and flaps extended for 90-deg. slipstream deflection. Deflection is tested (right).

Ryan Vertiplane Concept Utilizes Double Flaps, Oversize Propellers

San Diego, Calif.—Ryan Aeronautical Co. will base its light-weight, single place research VTOL airplane being built for the Army on a single turboprop engine driving oversize diameter propellers and a full span double flap system to achieve 90-deg. slipstream deflection.

Ryan has developed its VTOL thinking along these lines since 1940 and the YO-51 Dragonfly, an STOL airplane which utilized full span flaps and slots with spoilers for lateral control.

Powerplant presently planned for the VTOL airplane is the Lycoming XT53-L-1 rated at 825 shp., with a dry weight of 460 lb. Wing area will be small for conventional horizontal flight since vertical lift is obtained with the deflected slipstream. Light wing loadings will be standard for VTOL flight, but large overloads can be absorbed by utilizing STOL flight techniques.

Load Carrier

The Ryan design philosophy aims at a machine capable of the same maneuvers associated with helicopters, yet able to lift large loads under varying CG conditions and carry them long distance at medium speeds.

Called the Vertiplane, the new machine is in direct contrast to the Ryan X-13 Vertijet, a delta wing turbojet plane developed for the USAF and now undergoing flight test at Edwards Air Force Base, Calif. The Vertijet is a tailsitter. The Vertiplane stays in the same attitudes as a conventional aircraft regardless of the flight regime being performed forward, backwards or vertical. Adjustment of power and flap settings make transition from forward to hovering flight possible at an almost constant altitude.

In landing, first approach is made with some power and flap deflection. By adding both power and flap deflection in the proper ratio, hovering, then vertical flight will be achieved.

To Contract Stage

Ryan has made full-scale tests of deflected slipstream effects and has advanced its knowledge to where the present contract for a flying test research vehicle can be accomplished. The contract is for the Army, but is being administered by the Office of Naval Research.

Ryan visualizes commercial as well as military uses for the Vertiplane, which is designed to operate from small, unimproved landing areas and maneuver in any direction over all kinds of terrain. Its capabilities would be useful to the Navy in anti-submarine warfare.

In commercial fields, Ryan believes the principle could be adapted to feeder line transports to convey passengers to the larger, dispersed airfields from which jet airliners will operate. The design also would be applicable to executive and business aircraft.

Cleveland Pneumatic Employes Walk Out

Cleveland—An immediate wage increase of 17 cents an hour and a clause in the contract that would limit the amount of work farmed out by the company, are the two principal issues involved in the strike of Aerol Aircraft Employes Assn. against the Cleveland Pneumatic Tool Co. The company has offered an increase of 11 cents an hour.

Members of the association hold 49% of the company stock. The purchase of stock was made in 1953 with $11 million from two employe trust funds.

In negotiating a contract with the independent union last year, management agreed to a contract clause that limited to a degree the amount and type of work which could be farmed out to other companies.

One of the principal demands by management when negotiations got under way a month ago was that this clause be modified. The union wants the clause strengthened.

A prime contractor to national defense agencies as the largest supplier of airplane landing gear equipment, the firm is required to have and list subcontractors. In addition, the company says it is forced to farm out 11 to 17% of its precision operations because it is unable to employ enough specialized machinists.

News Digest

Bell Aircraft Corporation's Texas Division at Fort Worth has been awarded an additional $2.5 million development contract for the Army XH-40 helicopter program. The additional money is to finance more advanced phases of research and development of the turbine-powered Bell helicopter.

Britain's postmaster general, Dr. Charles Hill, announced that this summer BOAC will introduce regular flights from Manchester, England, to Montreal, Canada, to avoid current stopoff of mail in London.

RCAF has announced it will carry out modifications of two Comet 1A jet

FAIRCHILD C-123
TAKES THE LOAD OFF HIS MIND

When the Air Force moves bulk supplies and equipment or personnel, or virtually *any* equipment or men *anywhere*, they know they can put their confidence and their *payload* into Fairchild C-123's.

Especially designed to airlift large consignments of men and equipment with the greatest flexibility of movement, the C-123 needs only short unprepared fields to land and takeoff.

Easy-loading rear ramp shortens ground time, and the C-123's high-lift characteristics make possible quick, sure delivery to the rough spots, inaccessible or impractical to reach by any other aircraft.

For a wide range of performance, the Fairchild C-123 is a versatile, rugged transport that takes any load required in tough logistics assignments – another *proven* example of the *big job* capability that Fairchild builds into its aircraft.

FAIRCHILD

AIRCRAFT DIVISION • HAGERSTOWN, MARYLAND

A Division of Fairchild Engine and Airplane Corporation

. . . WHERE THE FUTURE IS MEASURED IN LIGHT-YEARS!

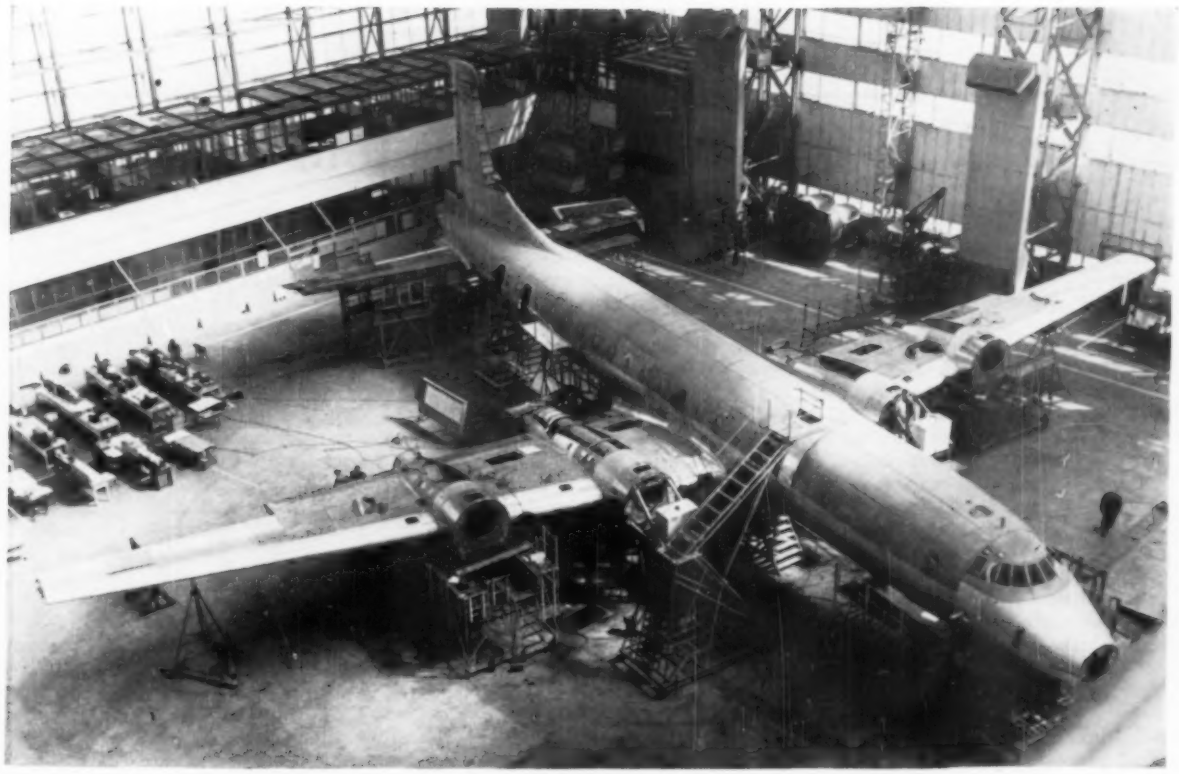
On highways and skyways . . .

To the leading builders of automobiles and aircraft, Kelsey-Hayes is a major source of vital parts. The large resources of Kelsey-Hayes make possible wide diversification, such as automobile wheels, brakes and brake drums, to name but a few. Equally important, in the aviation field, Kelsey-Hayes supplies engine components, assemblies and many other vital products.

KELSEY-HAYES

Kelsey-Hayes Wheel Co., Detroit 32, Mich. • Major Supplier to the Automotive, Aviation and Agricultural Industries

TEN PLANTS / Detroit and Jackson, Michigan; McKeesport, Pa.; Los Angeles, Calif.; Windsor, Ontario, Canada • Davenport, Iowa (French & Hecht Farm Implement and Wheel Division) • Springfield, Ohio (SPECO Aviation, Electronics and Machine Tool Division)



Britannia 300 Prototype Nears Completion

First of the longer fuselage Britannias is near completion at the Bristol factory and is to make its first flight soon. Fuselage is 10 ft. longer than Series 100 and is powered by Proteus 755 turboprops of 4,120 eshp. It can carry up to 99 passengers.

transports. Work, to take a year, will be handled by de Havilland factory at Broughton, England.

Germany has joined the International Civil Aviation Organization, the 68th nation to do so.

Iron Curtain observers will attend the 10th general assembly of the International Civil Aviation Organization in Caracas starting June 15. They will be among delegations sent by 68 member states, 10 non-member states and 39 international organizations. Agenda of 39 points includes the question of sovereignty over outer space.

B. F. Goodrich Co. has been awarded a U. S. Air Force contract for aircraft brakes and wheels amounting to $1.6 million. Order calls for 1,100 wheels and 3,980 brakes for fighter aircraft.

Boeing's 707 jet tanker-transport prototype is nearing the 500-hr. mark in flight time. Since its maiden flight on July 15, 1954, it has had some 415 takeoffs and landings, and has been flown by more than 100 pilots from 27 commercial airlines.

Canadair Limited of Montreal has a multi-million dollar contract from Canada's Department of Defense production for additional CL-28 submarine hunting planes for the RCAF. The amount of the order and a previous one has not been announced.

Boeing Airplane Co. of Seattle has arranged an open line of credit in the amount of $75 million with 17 banks in Seattle, Wichita, Kan., Chicago, New York, Pittsburgh and San Francisco. Credit, to run through June 1957, is to "finance research into new and better products and to finance larger facilities."

Bristol Britannia series 100 prototype G-ALBO is undergoing hot weather trials at Idris, North Africa, with Proteus 755 turboprop engine used for Britannia series 250, 300, 310. Tests are part of new engine's certificate of airworthiness trials.

Hughes Aircraft Co. of Culver City, Calif., has been awarded four USAF contracts totaling $39.4 million for production and maintenance of Hughes armament control systems for all-weather interceptor planes.

Three leading American banks are to lend Dutch KLM Airlines $50 million to finance purchase of new aircraft, including eight Douglas DC-8 jet airliners. The banks are First National City Bank of New York, the Chase Manhattan Bank and the Bank of America. Loan will be made available between 1956 and 1960.

Temco Aircraft Corp.'s contract for pylon assemblies for North American's F-100 Super Sabre has been increased by several million dollars by the Air Force. A large percentage of the work on the equipment—wing racks for armament and external fuel—will be subcontracted to other firms in the Dallas area.

A Skymaster purchased by Syrian Airways from the Potomac Co. of New York last year has arrived in Damascus after overhaul and refurnishing in Copenhagen. A German crew will man the craft.

Pan American Airlines has started seven day a week service to London from Philadelphia. Schedule replaces PAA's three day a week flights in which passengers were transferred at New York to overseas bound planes. New flights will overfly New York, make a stop at Boston.

Tacan Fit for Common System—ANDB

Report to Air Coordinating Committee stresses technical feasibility, stops short of urging adoption.

By Alpheus W. Jessup

San Francisco—Tacan is both feasible and practical for use in a common navigation system for civil and military air traffic, the Air Navigation Development Board reported to the Air Coordinating Committee last week.

Enough Tacan channels are available and the suitability of Tacan applies whether that system is "for civil and tactical military, or civil and non-tactical military aviation," according to the year-long study by ANDB.

The ANDB says that Tacan meets the technical requirements of a practical common system, but it does not recommend its adoption per se. It leaves to the Air Coordinating Committee the determination whether Tacan should be adopted for a single common system, or whether the present compromise parallel development of Tacan for tactical military and of VOR/DME for civil and non-tactical military traffic should continue.

ACC Begins Study

ACC met late last week to begin consideration of the ANDB report. It was expected that ACC would refer the report to its Air Traffic Control and Navigation Panel. The NavPanel would make recommendations for a U.S. policy on Tacan after consideration of financial requirements, timeliness and international implications.

Full scale adoption of Tacan as the common system would require revision of the Civil Aeronautics Administration's five-year program to modernize the air traffic control system (AW Apr. 30, p. 26). No provision for Tacan installations is made in its present plan. On the other hand, no expansion of VOR/DME facilities is included.

The gist of ANDB's recommendations regarding Tacan's technical qualifications for the common system were described by Col. J. F. Taylor, Jr., director of the Board, at the recent Aviation Writers' Assn. convention. His major points:

• **One hundred channels** are required in a Tacan system, which would provide area coverage of the U.S. in the air space from 75,000 ft. down to 18,000 ft. mean sea level and solid coverage on a basic route structure from 18,000 ft. down to 700 ft. above terrain. This coverage plan, "which satisfies all classes of aircraft and allows for new types planned," was drawn up by ANDB Advisory Group No. 3.

• **Of the 126 channels** designed in the Tacan system, 104 are available for common system use. The remaining 22 channels are either required for exclusive military use or lost because of interference from other services. Thus, common system channel requirements can be met with four channels left over for contingency purposes.

• **The need for Tacan** in the Continental Air Defense plans has been categorically confirmed by the Joint Communications-Electronics Committee.

International Problem

Another problem which ANDB originally set out to investigate was the international implications attached to Tacan standardization. Taylor said that this issue was outside the authority of ANDB and now would be acted on by ACC. ANDB recognizes the difficulty of solution, since the "military of NATO countries have the same interests in Tacan as do the military in the U. S., with civil aviation in these countries favoring VOR/DME in some instances."

"No technical problems are known that would prevent Tacan from taking its place as the rho-theta navigation aid in a truly common system," Taylor concluded. It was expected, however, that politics would still confound the two-year struggle with Tacan.

Range, altitude coverage and adjacent and co-channel protection ratios of a Tacan grid system were determined by Airborne Instruments Laboratory and Federal Telecommunication Laboratories. This provided a plan for siting ground stations. The minimum geographical spacing between facilities assigned the same channel for the different type facilities was determined to be:

• **200** nautical mile facility, 500 mi.
• **100** nautical mile facility, 250 mi.
• **30** nautical mile facility, 150 mi.
• **30** nautical mile instrument landing system, 150 mi.

From this data, the National Bureau of Standards determined that 100 channels would be required in a Tacan navigation system covering the country from 700 ft. above terrain to 75,000 ft. above mean sea level: 200 mi. facilities, 23 channels; 100 mi., 38 channels; 30 mi., 25 channels; and 30 mi. ILS, 14 channels.

CAB Begins Special Investigation Of Airline Reservation Policies

Washington—The Civil Aeronautics Board staff is conducting a special investigation of airline reservation policies and methods as a result of increasing complaints from Congress and the public that airlines are overselling flights and failing to give passengers adequate flight information.

Answering the complaint of Sen. Margaret Chase Smith (R.-Me.) that airlines are overselling seats, CAB Chairman James R. Durfee reported that the Office of Compliance is working on a survey of airline booking procedures for the Board.

Increasing complaints of overselling, especially on New York-Miami routes, led the CAB to begin a survey of the situation in March. Later, the study was expanded to include the question of airline policy in supplying flight information to passengers.

If the Board decides the Office of Compliance report warrants it, a full investigation may be launched. A probe of the oversale situation could include the no-show problem, another issue causing some concern at the CAB.

In her remarks on the airlines, Sen. Smith accused them of maintaining "an Iron Curtain on weather information for their own convenience and to prevent passengers from switching to railroad transportation when air travel becomes questionable . . ."

She also complained of what she termed "the reprehensible practice of airlines overselling and taking through-flight passengers off without advance notice, because of passenger stack-up resulting from overselling." She added:

"Most of us can remember a few years ago when there were predictions of gigantic expansion of air travel. We have seen a great expansion develop. But we have not seen a gigantic expan-

sion develop—not what most of us thought would have happened by this time.

"I think that the principal reason for this can be laid to the airlines themselves. There are not enough airlines with enough equipment and operating over enough routes to meet the demands of Americans for air travel."

The senator argued that: "The answer lies in having more competition over the existing routes by more airlines instead of the present system of granting a quasi-monopoly to a few favored airlines with the concurrent discriminatory treatment against other airlines which have asked to provide service over existing routes."

The ranking Republican member of the subcommittee on CAA and CAB appropriations, Sen. Smith, said she has been "shocked at the callousness of the attitude of the airlines, particularly the big airlines operating on the East Coast, on such matters as reservations, overselling, flight connections and withholding flight information."

Senate Approves Budget

CAB's new chairman, James R. Durfee, in a letter to Sen. Smith reported that overselling "has been a cause of concern to us for some time" and that "an investigation was begun several weeks ago."

The Senate Appropriations Committee also has directed the CAA "to take the necessary steps" to improve weather information to airline passengers.

Despite the charges on the floor, the Senate approved the $202 million budget for CAA and the $22.1 million budget for CAB recommended by its Appropriations Committee.

For CAA, this is $6.1 million more than the House allowed, but $392,000 less than its original request. The Senate restored a $2.5 million cut made by the House in the CAA's $40-million request to launch its five-year federal traffic-control plan.

The Senate also restored $2.4 million of a $5 million cut made by the House in the CAB's request of $20 million for payments of airline subsidies.

During Senate debate on the budget requested, Sen. Paul Douglas (D.-Ill.) applauded the reduction in the appropriation for airline subsidies from the $52.5 million granted for Fiscal 1956.

"We have galvanized the General Accounting Office into a more-detailed audit of the expenditures of the airlines," Douglas declared. "I hope we can continue in that direction. I think we have galvanized the CAB into taking more decisive action. I hope they will continue with their good work and will do still more."

Kerosene Safer for Commercial Jet Operations, Esso Claims

Boston—Kerosene is a safer fuel for commercial jet operations than JP-4, an oil company expert told members of the National Fire Protection Association at their aviation seminar last week.

A jet transport with integral wing tanks will be exposed to a flammable vapor condition to a considerably lesser extent with kerosene, asserted A. R. Ogston, technical service representative of the Esso Export Corp. Aviation Department. Furthermore, he said, in aircraft crashes kerosene fires will spread more slowly than JP-4 fires and offer additional time for passenger evacuation.

Engineers for the Texas Co. found in a testing program that JP-4 compares favorably with kerosene in performance, and has advantages of compatibility with engine design, lower freezing point and is less dangerous at high altitude (AW May 28, p. 84).

Weight Advantage

Ogston did not give the weight to the advantages of JP-4 that the Texas engineers did.

"The major oil companies are in a position to supply whatever type of petroleum fuel is desired by the airline customer," Ogston said. "The sale of JP-4 rather than kerosene may appear to be more attractive to some oil companies since it may be a convenient outlet for low octane naphthas which are sometimes difficult to dispose of in these days of 98 octane premium motor gasolines.

". . . Factors of this kind should not influence the choice of a jet transport fuel grade, which must be selected on the basis of its overall operational suitability.

"In evaluating the latter, an all-important consideration should be the comparative safety characteristics. . . . Kerosene of minimum flash point represents the best compromise that can be made in selecting a fuel for the coming jet transport era."

Flammable Range

During a typical seven-hour jet transport flight where fuel temperature does not exceed 70F at takeoff, flammable kerosene vapor should not occur during any part of the flight, according to Ogston.

With JP-4 fuel on the other hand, the flammable range would be entered at about 0F, or within one to three hours after takeoff, and the condition would remain thus for the rest of the flight.

With fuel temperatures above 70F at takeoff, flammable kerosene vapor would be present during the early part of the flight. With JP-4, the warmer the fuel at takeoff, the longer it will take tank vapor to enter the flammable range.

But it would be certain to do so in any case during final let-down from cruising altitude.

The fuel tank vapor-flammable range for kerosene, according to Ogston, runs from 95F to 165F at sea level, to 35F to 80F at 50,000 ft. Comparable range for JP-4 is −0F to 70F at sea level, −57F to −3F degrees at 50,000 ft.

Ogston pointed out that flammable vapor in the tanks is a hazard only if a potential source of ignition exists. Lightning strikes appear to be the only real ignition source, and they do not usually occur near normal fuel locations.

No accidents to civil aircraft have been attributed thus far to vapor explosion, Ogston said.

Eastern-Colonial Join, Trunk Lines Cut to 12

The number of U. S. trunk airlines dropped to 12 on June 1 when the long-planned merger between Eastern Air Lines and Colonial Airlines became effective.

Eastern took over Colonial in a trade of one share of Eastern stock for every two shares of Colonial stock. Eastern traded 260,300 shares for Colonial's property and route system.

For the present, Colonial becomes the Colonial Division of Eastern Air Lines and former Colonial president Branch T. Dykes becomes an Eastern vice president in direct charge of the division.

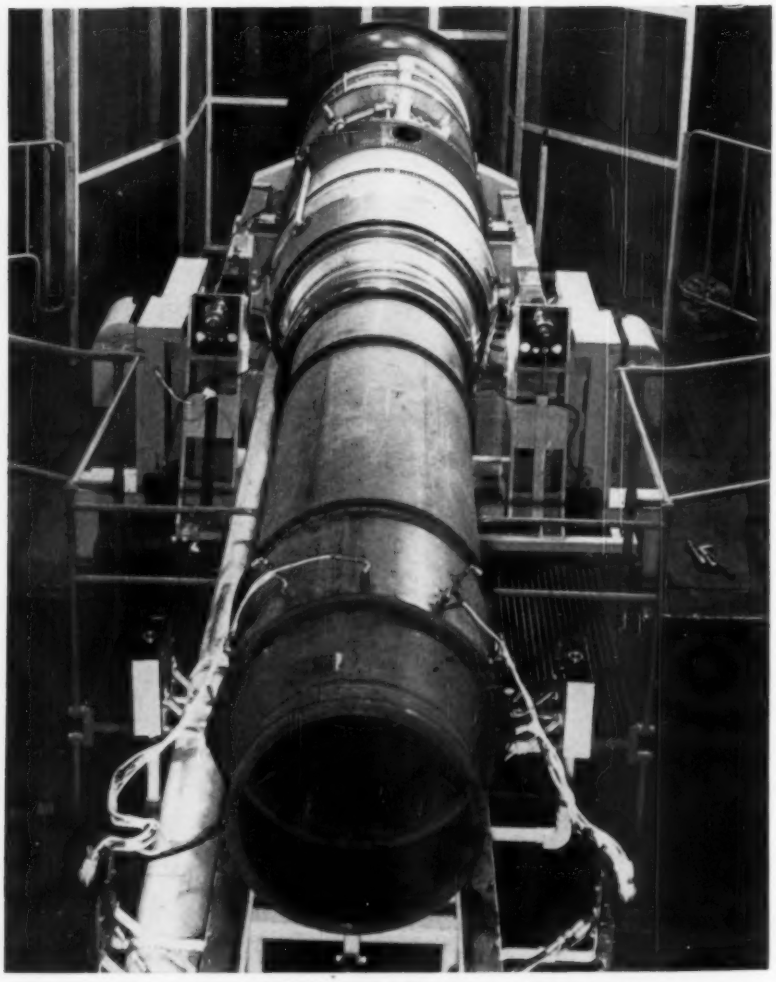
The merger ends a four year fight for Colonial.

National Airlines fought the acquisition bitterly in a long series of proceedings before the CAB, in the courts and at the White House.

In return for 260,300 shares of stock, Eastern received routes to Ottawa and Montreal and to Bermuda and added a total of five DC-4s and eight DC-3s to its fleet.

The Colonial Division will continue to operate the Colonial system with its own equipment and personnel for the present.

Eastern will follow a policy of gradual integration in absorbing the Colonial operation and introducing new equipment on the new routes.



Olympus 101 Installed on Test Bed

Bristol Olympus 101 turbojet engine rests on test bed. Engine, which develops 12,000 lb. thrust, is in production to power Avro Vulcan bomber. Civil version was recently announced by Bristol Aero-Engines Ltd. Later versions of engine are running at considerably higher powers.

Airline Traffic Rise Of 15% Is Forecast

Boston—Airline traffic will increase at a rate of 15% a year and lower fares will play an important part in tapping new air transportation markets, Dr. T. P. Wright, Cornell University vice president of research, predicted last week at a meeting of the Radio Technical Committee for Aeronautics.

The major problems of traffic control and adequate airport facilities for the jet age will be solved by 1960, Wright said. Technological developments in steep gradient landing and takeoff aircraft and supersonic commercial flight will be achieved sooner than we think.

Relating passenger market to fares, Wright said the potential market increases inversely as the cube of the fare. If in future U. S. airline fares come down from the present average of 5.34 cents per passenger-mile to 3.31 cents this country's present market potential of 10 million passengers would rise to 40 million, the Cornell scientist said. The 3.31 cents fare level is equal to present first class railroad fares.

Other points made by Wright:

- **Separation of airports** for exclusive use by carriers, personal aircraft, executive aircraft, and cargo operations may be necessary to solve the airport problem.
- **Boundary layer control** can reduce landing and takeoff distance on the order of 30 or 40% and research and development on it should be intensified.
- **Rocket-assist takeoffs** and arresting gear landings for shorter runway use, and air refueling in commercial operations should be given consideration.

Baggage Delivery Plan Offered by American

American Airlines is now offering what it hopes will be a solution to the baggage-claiming problems of New York and Los Angeles passengers through a new downtown baggage delivery service.

For a small fee, American will arrange to have luggage delivered to passenger-specified points in either New York or Los Angeles, saving the passenger the trouble of waiting for the baggage to be unloaded and then carrying it himself.

In New York, American will have baggage delivered in Manhattan, Queens, Brooklyn and the Bronx. For a destination between the Battery and 86th St. in Manhattan, the charge is $2 for the first bag and $1 for each additional piece. For other destinations, the charges are $3 and $1.50.

West Coast delivery service extends to Los Angeles, Hollywood, West Hollywood and Beverly Hills. Rates are $2 for the first bag and $1 for others in Los Angeles, and $3 and $1.50 in Beverly Hills, Hollywood and West Hollywood.

Carey Limousine Corp. and Mercury Service Systems will handle the deliveries in New York, and Airportransit, Inc. and Atlantic Transfer Co. will deliver in Los Angeles.

Local Coach Flights Planned by Southwest

Washington — Southwest Airways plans to become the first local airline to offer coach service, with low fare flights between major California cities.

The new coach service is scheduled to begin this month.

Southwest has filed a coach tariff with the Civil Aeronautics Board which offers low-fare service between 5:45 P.M. and 8:30 A.M. The coach service will be operated with 44-passenger Martin 2-0-2 aircraft.

Fares will vary from $3.50 to $17.00, and the coach proposal includes service to San Francisco, Oakland, Sacramento, San Jose, Monterey, Santa Barbara, Bakersfield, Burbank and Los Angeles.

Italian Pilots Suspend Strike Against Lines

Reacting to a move by Italian airline companies placing staffs on vacation and offering some planes to hire to foreign companies, Italian airline pilots suspended their strike May 27. Service was partly restored by May 30, but negotiation is expected to resume on wage demands.

IATA Conference Probes Traffic Snarl

Air traffic control and navigation problems dominated the 1956 International Air Transport Assn. Technical Conference completed late last month at San Remo, Italy.

The Technical Conference repeated the alarm expressed earlier at IATA's annual general meeting over the rate at which control and navigation facilities are falling behind aircraft development in many areas.

The group also approved a series of short- and long-range recommendations for improvement of present facilities and development of new ones to handle air traffic in the 1961-70 decade.

Last fall, the Technical Committee estimated that an hour of non-productive flying with a modern transport costs $1,000 and pointed out that if traffic snarls caused non-productive flying which amounted to 2% of annual utilization, it would cost the airlines millions of dollars.

At the San Remo meeting, the IATA group pointed out that in many parts of the world, air traffic control and navigation aids already are five years behind current aircraft capabilities and that, unless something is done, the introduction of turbojet and turboprop transports will widen the gap still further.

Conference Recommendations

Lack of implementation of regional plans drawn up by the International Civil Aviation Organization by the governments concerned was cited as "the great void" in the traffic-control situation by Col. C. A. Dougherty, chief of the Civil Air Branch of the USAF. He urged technicians to concentrate more heavily on impressing industry and government with the urgency of the situation.

Dougherty said that U. S. military forces support civil aviation development, but he warned the delegates against depending upon military resources and funds since they are subject to redeployment.

The Technical Conference made several recommendations for improvement of present traffic-control facilities and procedures, including full-time control in congested areas regardless of weather conditions.

Primary radar was described as one of the best tools currently available for reducing aircraft separation and improve traffic handling, and IATA was urged to promote early development of an internationally-compatible system of secondary radar.

Until automatic communications for continuous position fixing are available, the Technical Conference said present traffic-control procedures can be improved through a standard phraseology and procedure and through correct sequence in data transfer. Other suggested improvements called for the speeding up of transmissions and the recording and institution of a standardized reporting procedure for pilots.

Where frequency of position reports and navigational accuracy permit it, the Technical Conference said longitudinal separation minima can be reduced and the load of position reporting cut. Studies of these possibilities by regions and routes were proposed.

Anti-Collision Lighting

The IATA group recommended that no aircraft be permitted to come closer than 500 ft. to another for military identification or any other reason, and that no aircraft be permitted to cross the flight path of another in the same proximity.

It was suggested that airlines support experiments in anti-collision lighting and that IATA conduct a detailed study for standardization.

The conference pointed out that, since turbine aircraft will be holding in traffic patterns at considerably higher altitudes, more efficient high altitude altimeters should be developed to allow aircraft to maintain the 1,000 ft. vertical separation standard (see Cockpit Viewpoint, p. 47).

Future ATC Systems

A detailed study was "urgently" recommended to determine whether holding patterns and procedures now in use can be applied to turbojet transports.

The airlines were advised to urge their governments not to create special reserved zones for military operations and to promote joint planning for maximum integration of military and civil traffic.

Looking beyond present navigation and control facilities, the Traffic Con-

Fare Cut Timing Now Is Dispute Hinge

Cannes—Opposition to American proposals for a third-class transatlantic airline fare appeared to be weakening last week among Europeans at the International Air Transport Assn. meeting.

The civil aviation chiefs of 14 European countries issued a joint policy statement in Paris just before the Cannes meeting opened opposing any such fare cuts. But now, in closed committee talks, word is that Europeans are arguing more against the timing of the fare cuts rather than against an eventual lower fare. Observers believe there's a chance of a compromise.

Main argument against the fare cut seems to be the costly modification and replacement of equipment. An excursion fare or something like it may be acceptable to the Europeans.

Rene Lemaire, French civil aviation chief, said at the Paris meeting that the fourteen European governments would not stand for a rate war. Rather, he said, they would pass by IATA and start negotiating with the State Department.

First 440 in Australia

Two Convair 440 Metropolitan aircraft have been bought by Australia for its VIP flight and the first one has reached Canberra. British aviation manufacturers, headed by Vickers, have voiced their disappointment at the selection of a U.S.-made plane for this purpose but RAAF, which is flying the plane (with RAAF markings in the photo), has expressed its preference for the Metropolitan.

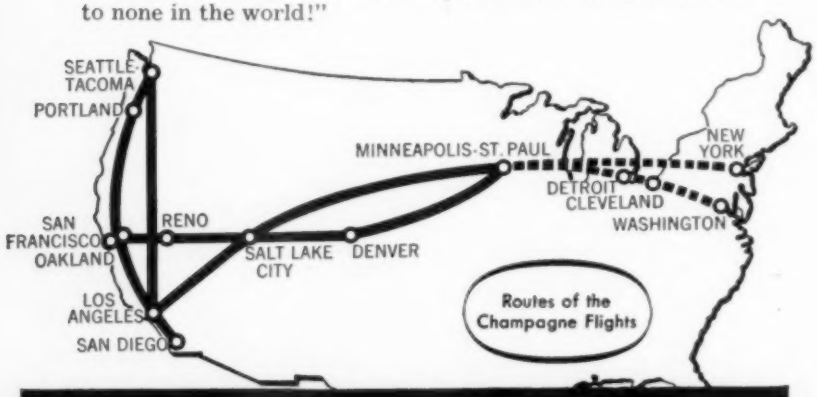
A great new route for America's smartest air service!

Champagne Flights

between

San Francisco • Salt Lake Denver • Minneapolis

Now Western Airlines links other great cities of the West with its famed DC-6B "Champagne Flights". These newest "Champagne Flights" between San Francisco, Oakland, Denver, and Minneapolis-St. Paul—via Salt Lake City and Reno—feature reserved seats, gourmet dining, vintage champagne, and orchids for the ladies – the same luxury service that travelers on Western's other major routes acclaim "second to none in the world!"



WESTERN AIRLINES

ference concluded that systems of the future most suited to meet IATA traffic-control requirements "may depend upon forms of control or coordination appreciably different from Air Traffic Control as we know it today."

The group said the search for the proper future system should proceed from the determination of agreed objective requirements, rather than from attempts to change or expand present facilities.

While ATC systems 15 or 20 years from now may not be fundamentally different in purpose from those in use today, the conference said that increasing traffic speed and density will require a spectacular increase in speed of communication and greater discipline for the pilot and operator.

To fill the need for faster communications, the group advised large scale simulation evaluation of the various integrated data transfer and signalling systems now under study in order to prove them out before they go into actual service.

Visual Navigation Aids

The conference also stressed the need for cockpit instrumentation which would give the pilot a visual picture of his place in the ATC pattern. While self-contained navigation aids independent of ground stations will be available in the next few years, the group pointed out that airlines have no experience with them and will have to use them as complements to present systems in the beginning.

The IATA group recommended that, in the future, air traffic control should be based on an area rather than a route concept. This shift is favored as a means of giving operators the flexibility they need to meet changing weather conditions and other factors in each operation.

In view of the increasing speeds of aircraft, the conference agreed that it would be unrealistic to set up control areas and other airspace compartments strictly within national boundaries. In the future, the group said, areas should be related to the nature of the route organization and defined without reference to ground frontiers.

Jet Runway Requirements

Examining runway requirements for jet aircraft, the Technical Conference concluded that the present standard width of 150 ft. will handle the jets if the runways are equipped with stabilized shoulders.

It was noted that in areas where 20 knot crosswinds are frequent or where high snow banks or other unusual factors exist, wider runways may be necessary. It was decided that airport problems should be handled on a local basis, taking into account the particular type of airline operation in the area.

Local runway requirements should be fixed as soon as possible, the conference concluded, because it takes two years to get a runway into operational use once the requirements are set.

Further study was advised on ground handling problems with turbine aircraft, although the conference agreed that fixed service installations should be used for fuel, ground electrical power, telephone, water and lighting.

Discussions were held on structural fatigue problems, and the group reported that the problems involved require considerable expansion of present airline inspection techniques and may call for supplementing visual inspection with radiography, ultrasonics and even radioactive isotopes.

The conference found that the problem of fitting message traffic into the limited frequencies available for areonautical mobile communications can be relieved by cutting down on redundant conversation.

It was suggested that routine in-flight weather observations be transmitted only by specified aircraft on a route rather than by all of them. New operational practices to streamline transmission of weather information to aircraft from the ground by airlines were also suggested, as was a study of suitable abbreviated phrascology to convey basic ceiling and visibility observations.

East German Airline Plans To Operate Jet Service

Bonn—The East German Deutsche Lufthansa expects to operate modern jet planes in the near future on an expanded route pattern. The jets will be made available by East German industry, a spokesman said.

The airline recently established two new routes—Berlin to Bucharest and Berlin to Sofia—over which it is operating Soviet Il-14 aircraft. Also planned for early operation are new routes within the Soviet Zone and an extensive network of feeder services.

Rising Cost of Airliners

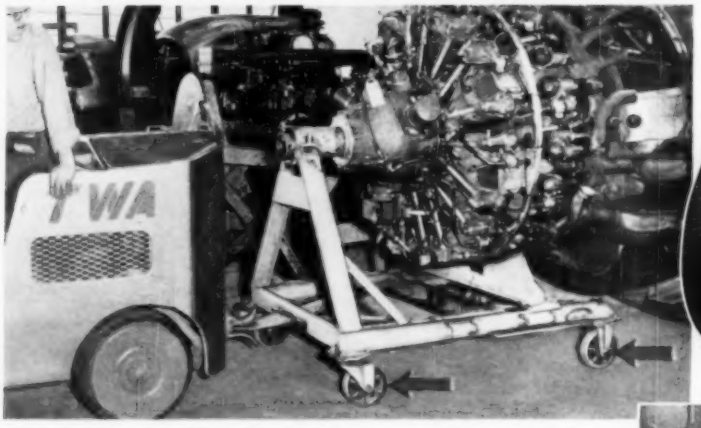
The rising costs of aircraft to the airlines as compiled by the Air Transport Assn. The cost includes one set of engines:

	LOCKHEED			DOUGLAS	
Year	Quarter	Model	Price	Model	Price
1946	1	049	$684,398		
	2	049	705,624	DC-4	$388,500
	4	049	785,940	DC-6	587,554
1947	1			DC-4	447,828
	3	649	754,930	DC-6	627,210
	4			DC-6	655,672
1948	2	749	870,690		
	3			DC-6	678,322
	4	749	923,033	DC-6	681,775
1949	2				
	4	749	1,076,940	DC-6	751,396
1950	1				
	2	749	899,983	DC-6	857,632
	3	649	897,490		
1951	2			DC-6B	940,848
	3			DC-6	873,889
	4	1049	1,256,478	DC-6B	958,190
1952	3	1049	1,256,118	DC-6B	1,015,932
1953	3			DC-6A (Cargo)	1,023,192
	4	1049-C	1,461,400	DC-7	1,640,050
1954	1	1049-C	1,490,404		
	2			DC-7	1,668,964
	3			DC-6A (Cargo)	1,501,693
	4			DC-6B	1,105,470
1955	1	1049-G	1,961,703	DC-6B	1,494,442
	2			DC-7B	1,898,700
	3			DC-7B	2,019,400

BOEING			VICKERS		
Model	Price		Model	Price	
377	$1,468,951	Figs. for 1949 2 in above	Viscount	866,800	Figs. for 1955 Qtr. 3
377	1,566,911	Figs. for 1950 1 in above			

HOW Faultless AIRMASTER CASTERS ARE SERVING AVIATION

TRANS WORLD AIRLINES GETS SAFE, FAST RESULTS WITH FAULTLESS CASTER EQUIPPED ENGINE STANDS



AIRMASTER Series 600 Faultless Caster cut-away to show two full rows of hardened bearings swiveling around large diameter raceways.

Roller bearing, Vulcanized Rubber Tired Wheel shown. Semi-Steel, Drawn Steel or Plaskite wheels are also available to suit load and floor requirements.

Huge Super Constellation engines are easily moved on Faultless Casters several hundred feet to the TWA overhaul area. There they are transferred to special Faultless Castered stands, allowing engines to be rotated horizontally or vertically for maximum accessibility. The engines and stands move along a production line of several stations where specific work is done on them. As many as 80 engines are on stands at one time. Faultless Casters not only permit fast material handling but the 2½" wheel face protects the plant's floors. The advantages of this type of material handling equipment are numerous, since the conveyance provides a combined work stand and storage dolly. Your local Faultless Industrial Distributor can recommend similar time and money saving methods for you, no obligation.

TWA Martin being re-assembled, with Faultless Castered transport and overhaul stands in foreground

Two of many Shock Absorbing AIRMASTER Casters produced for the Aviation Industry

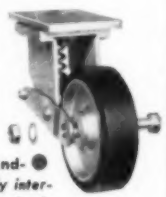
DUAL-WHEEL SPRING LOADED

Made in accordance with Military Specifications. Write for specification data.

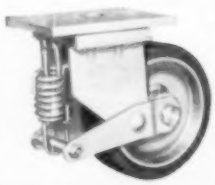
SPRING ACTION POSITION LOCK ON SWIVEL

3 FEATURES EXCLUSIVE WITH SHOCK ABSORBING AIRMASTER CASTERS

● Shock-Absorbing Spring Action *parallel to the center line of King Bolt* to balance the load and allow wheel to be in contact with floor at all times, regardless of rough floors or bumpy terrain.



● Caster wheels of standard design are *easily interchangeable with stock wheels* to minimize maintenance and "down" time.



● Spring Action Caster *continues to function as conventional Caster* in case overload exceeds maximum spring load rating. An important safety factor to load operators.

FAULTLESS CASTER CORPORATION, EVANSVILLE 7, INDIANA

Offices in Atlanta, Baltimore, Boston, Buffalo, Chicago, Cleveland, Dallas, Detroit, Grand Rapids, High Point, Indianapolis, Los Angeles, New Orleans, New York, Philadelphia, Portland, Seattle, St. Louis, Canada: Stratford, Ontario

World Airline Orders For Viscounts at 316

Production rate of Viscounts is six to seven a month and will continue at that rate until the end of the year. Twenty-six Viscounts have been delivered so far this year, and the total deliveries at the end of May was 117. There have been 316 Viscounts sold.

Airlines taking recent deliveries or placing orders:

• **Central African Airways.** Delay in delivery of five aircraft was requested because airport program was not complete, but first one was delivered in April and second was to be delivered in May.

• **Capital Airlines.** Twenty-four aircraft were to be delivered by the end of May, one behind schedule.

• **Trans-Canada Airlines.** Eighteen aircraft delivered through May, ahead of the airline schedule.

• **Trans-Australia Airlines.** Option on two Viscount 810Ds, bringing fleet to 13 aircraft.

• **Cubana** (Compania Cubana de Aviacion). First delivery last month.

• **Lufthansa.** Option on seven.

• **Pakistan International Airlines.** Option on three.

• **British European Airways** announced deliveries of 20 Viscounts fitted with four Rolls-Royce RB-109 Tyne turboprop engines will begin in the spring of 1960.

A formal contract will be signed by BEA Chairman Lord Douglas soon.

Of the 316 Viscounts ordered, 86 are 800 series and 230 are 700 series.

CAB Nod to Southern For Florida Service

Washington—Southern Airways has been chosen by the Civil Aeronautics Board to operate a new direct air service between Atlanta and Panama City, Florida.

The Board selected Southern over Eastern Air Lines and National Airlines to operate the 250-mile route for a five-year experimental period. The local airline will operate the route via Columbus, Ga., and Dothan, Ala.

The Atlanta-Panama City segment is primarily a local service-route, and the CAB ruled that a local airline (Southern) would do a better job of serving and exploiting it.

The Board decided to allow Southern to operate skip-stop and nonstop service on the route so long as Dothan and Columbus get two flights a day in each direction.

CAB member Chan Gurney disagreed with the majority on two points. He feels the Board should have given Southern permanent authority instead of a five-year certificate. Gurney also thinks Southern should be restricted to one-stop service on the route; he feels nonstop authority tends to make the segment a trunk route.

Planning further expansion in the Florida area, Southern has asked the CAB for a new route from Jacksonville to Miami via Gainsville, Ocala, Winterhaven and Fort Lauderdale.

Antarctic Air Route Studied in Canada

A route over the Antarctic between Australia and Europe, with a stop at the south polar icecap, is under serious consideration by Canadian Pacific Airlines, Grant McConachie, president, has said.

Establishment of refueling facilities on the icecap would involve no problems not already overcome on the northern polar route, McConachie said.

Boeing Weighs Short Range Jet Transport

Seattle—Production of a short-range jet transport in conjunction with its Model 707 Jet Stratoliner series is under consideration by the Boeing Airplane Co., Wellwood E. Beall, senior vice president, has revealed.

The plane would be in the 60,000 to 140,000-lb. weight range, as compared to the 235,000 lb. of the 707. It would carry 50 passengers and travel at about 575 mph. It probably would have four engines, Beall said. Deliveries could begin in 1961.

Availability of suitable engines is a key point in determining whether a useful and economical airplane can be offered in the near future on a firm basis and whether sufficient airline interest can be developed to make the project feasible, said E. C. Wells, engineering vice president, who is overseeing preliminary work on the project.

Among lines which have expressed interest in the new jet are Northwest Orient, United, Trans World, Western, Continental, Northeast, Trans-Canada and National.

CAB ORDERS

(May 24-30)

GRANTED:

Flying Tiger Line an exemption to perform two charter flights from Munich to New York pursuant to a contract with the Intergovernmental Committee for European Migration.

Purdue Aeronautics Corp. an exemption to perform a round-trip charter flight between Lafayette, Ind., and North Bay, Ontario, Canada, pursuant to an agreement with the Indamer Corporation.

Seaboard and Western Airlines an exemption to transport Mr. Wayne Thomas of the Chicago Tribune from New York to Dusseldorf and return via Gander, Shannon, London, Brussels, Frankfurt, Nuremberg, Munich and Stuttgart for news purposes, provided Seaboard collects a $618.20 fare from the passenger.

Riddle Airlines an exemption to lease one C-46 aircraft from Miami Aircraft and Engine Sales and two C-46 aircraft from Southern Aircraft Leasing Co. for 36 months with options to purchase.

Flying Tiger Line an exemption to perform transatlantic charter flights for the Italian Alliance Clubs and the Blau Weiss German Beneficial Union, and Slick Airways an exemption to perform two round trip transatlantic charter flights for the Youth's Division of the Order of Good Templars.

North Central Airlines authority to conduct round trip service on Segment 1 of Route 86 between Land O'Lakes, Wis., and Chicago, Ill., via Rhinelander and Milwaukee, provided the carrier serves each intermediate point on the segment on at least one round trip daily.

Pan American World Airways permission to serve Kano, Nigeria, through the Kano Airport.

Slick Airways an exemption to perform two transatlantic charters and Flying Tiger Line an exemption to perform one transatlantic charter pursuant to contracts with Sperry employes Cosmopolitan Club.

City of Columbus and the Columbus Chamber of Commerce permission to intervene in the Eastern Route Consolidation Case.

APPROVED:

Control relationship between Modern Air Transport, Aviation Management Corp. and John P. Becker and interlocking relationships among the three parties.

Agreements involving members of the Air Traffic Conference of America and various other carriers relating to intercarrier arrangements.

ORDERED:

Ozark Air Lines' temporary mail rates set at $2,023,886 for the period April 15, 1955, to Mar. 31, 1956, and 53.47 cents per mile for the period beginning April 1, 1956.

Mail rates for American Air Export and Import Co., Riddle Airlines, Slick Airways and the Flying Tiger Line set at the standard rates set for the airlines Oct. 7, 1955.

Seven States Area Investigation broadened to include the issues of deletion or suspension and replacement of service by Braniff Airways at St. Joseph, Mo., and Rochester, Minn.; service by Western Air Lines at Chadron, Neb., and service by United Air Lines at Grand Island, North Platte and Scotts Bluff, Neb., and Iowa City, Iowa.

West Coast Airlines to show cause why the CAB should not set mail rates of $3,354,156 for the period Nov. 1, 1953, to Oct. 31, 1955, and $1,798,102 for annual periods starting Nov. 1, 1955.

Alaska Airlines' temporary mail rates set at the rates proposed by the board for the period starting April 4, 1956.

DENIED:

Allegheny Airlines' petition for reconsid-

DME

Ready TODAY for the Jet Transports of TOMORROW

Narco DME gives pilot precise distance from VOR/DME or ILS/DME stations in nautical or statute miles on one of two scales selected by "range" knob—0-20 miles; 0-200 miles. Permits quick, accurate, continuous check of ground speed, expedited straight-in approaches, positive position indication at all times. Completely detailed brochure available.

The CAA Distance Measuring system is in full operation on virtually every major Federal Airway, providing pilots with information they have always wanted, never had—*distance* from a radio fix, as well as direction.

Hundreds of airline and executive aircraft use this navigation system daily—expediting IFR approaches, taking the guesswork out of position reports. The majority of these aircraft are equipped with Narco DME.

Narco Distance Measuring Equipment meets CAA specifications for airline use, is completely proven, accurate, reliable. It is in full production.

VOR/DME is ready TODAY for TOMORROW's era of jet transport, which will require the precise type of navigation provided only with *Distance Measuring*. It is ready, too, for TODAY's business and airline aircraft.

A **narco** Sapphire *PRODUCT*

NATIONAL AERONAUTICAL CORPORATION • AMBLER, PENNSYLVANIA

eration of earlier CAB action denying the carrier authority to operate a one-stop service between Pittsburgh and Buffalo.

Airborne Freight Corp.'s petition for reconsideration of CAB action denying a request for investigation of certain Slick Airways specific commodity rates and minimum charges.

Permission to intervene in the Reopened Bonanza Renewal Case to City of Fresno, Calif., Board of Supervisors of Fresno County and City Chamber of Commerce.

California Eastern Aviation's motion for consolidation of its application for disclaimer of jurisdiction and for approval of control in the Large Irregular Case.

Shortlines

▶ **Arkia Airlines,** an Israel Government-owned carrier, is operating two flights a day between Lydda Airport at Tel Aviv and Eilat on the Red Sea. The service is operated with 30-passenger DC-3s.

▶ **British European Airways** has taken options on 19 more Viscounts—Seven 810s and 12 840s. Delivery on the options will bring BEA's Viscount fleet to 83 aircraft by 1960.

▶ **Central African Airways** carried 247,805 passengers in the year ending March, 1956, with gross revenues of $6.6 million for the period.

▶ **Flying Tiger Line** flew 6,458,885 ton-miles of freight in April a 10% increase over April 1955. The carrier flew 23,203,726 ton-miles of freight in the first four months of the year, 40% more than in the similar period of last year.

▶ **Holiday Airlines** will inaugurate a scheduled service between the San Francisco Bay area and Lake Tahoe on June 15. A daily schedule of two round trips between Sausalito and Lake Tahoe will be flown with nine-passenger Grumman amphibians. Fare is $14 one way; $27 round trip.

▶ **National Airlines** will install anti-skid devices on all its Convair 340 and 440 transports. The carrier will use the Decelostat Controller built by the Westinghouse Air Brake Co. to adapt braking systems to various runway surface conditions.

▶ **Trans Australia Airlines** has sold one Convair 240 to Pakistan International Airlines and is negotiating the sale of four more with various airlines as part of its program to re-equip with Viscount and F-27 aircraft. Ansett Airways is reported interested in two of the Convairs, but TAA won't sell to a competitor.

Measuring Altitude

A matter of increasing concern in aviation is the measurement of altitude. Present barometric altimeters do not give a sufficiently accurate answer to the question, "How high is the aircraft flying?" As might be suspected, the most crucial points are the extreme ends of the scale—on low instrument approaches and during high level flight.

Modern technology permits us to measure distance and direction with useable accuracy by means of electronic devices. But these factors constitute only two-thirds of the needed information.

The third dimension, altitude, still is strapped to a tool which utilizes a bellows.

Elusive Standard

The development of the sensitive altimeter several years ago permitted great strides in aviation. Now the industry is stepping into regions of flight where more reliable data is required. Inherent faults of present equipment, as hysterisis and lag, are of more than academic interest. Indeed, that all important reference point, sea level, appears to be an elusive standard.

Lacking anything like a stable bench mark, accurate readings are hard to come by.

Landing minimums have reached the 200-ft. point, which in anybody's language is mighty close to the ground. Errors of any type at this low altitude, be they installation, design, reading or what have you, can have an unhealthy effect on further operations. And the various errors can accumulate to approximately 100 ft.!

Many people believe that the useful limit of the pressure altimeter is reached in the neighborhood of 200 or 300 ft., and that beyond this we must depend on other things—approach lights, for instance.

Likewise, at high altitudes—above 15,000 ft.—the system has shortcomings which can cause the required 1,000 ft. spacing to disappear. Instances have been reported in which an aircraft cruising at 20,000 ft. (according to the altimeter) finds itself passing under a flight whose instrument says 19,000. Above these levels the errors naturally tend to become greater.

Millibar Spacing

To prevent these awkward situations, consideration has been given to the separation of aircraft according to a specific number of millibars of mercury rather than by 1,000-ft. intervals. The hitch is that the millibar expands with altitude. If X-millibars yield 1,000 ft. down low, then X-millibars may produce several times this space up high—obviously an impossible extravagance.

Some recent developments in the altimetry field have produced fantastically accurate pressure-type instruments, as the one being made by the Bulova Watch Co. (AW Dec. 5, p. 29). Elaborately compensated, these precision devices may find use for calibration of existing equipment, as ground station masters and, possibly, inflight use on large aircraft. But these altimeters do not change the present system: what they do is merely refine it.

It would appear that our third dimension needs some sort of electronic measurement. And I don't mean the old terrain warning indicator, although this may have its uses. People in the know tell me that the present state of the electronic art does not permit the establishment of an electronic bench mark from which we can measure—either up or down. But there is a fortune waiting for the person who can come up with a suitable aeronautical yardstick.

Silently, at 900 feet per second, they close in from the horizon. Their formation is diamond, the distance between each Cougar a precise five feet. Too near the earth, they roll as one and noisily loop. On each low return, the crowd gasps, but the five feet separation remains exact throughout their aerobatics.

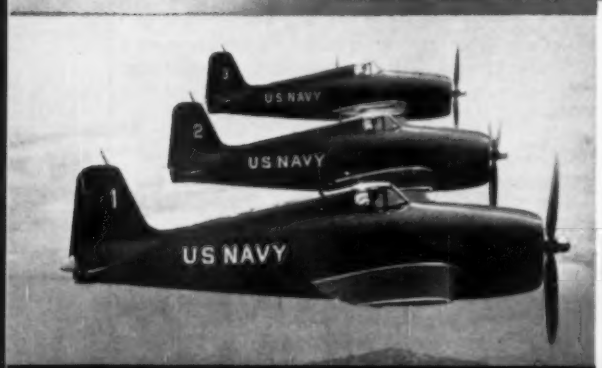
These are the Blue Angels, U. S. Navy Flight Demonstration Team. Their primary mission is to show fledgling Navy pilots the perfect skill with which practiced men can fly when they have complete confidence in themselves, their team, and their airplanes. To insure the latter, the choice of airplanes has always been left to the Blue Angels. Since their inception ten years ago, they have tested all new Navy fighters and chosen Grumman every time.

GRUMMAN AIRCRAFT ENGINEERING CORPORATION

Bethpage • Long Island • New York

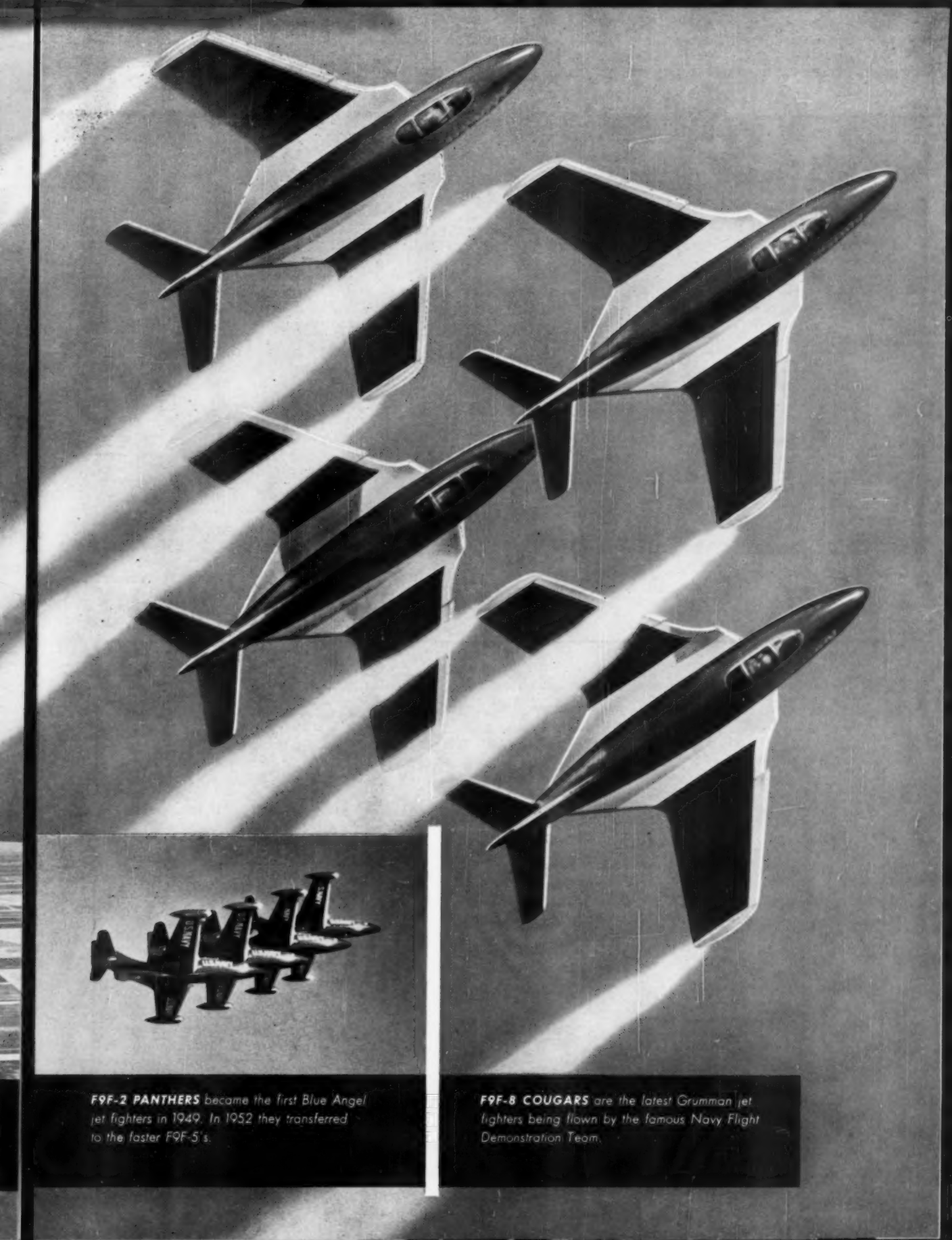
Designers and builders of supersonic F11F-1 Tiger, transonic F9F-8 Cougar, S2F sub-killer, SA-16 Albatross rescue amphibian, metal boats, Aerobilt truck bodies.

Grumman



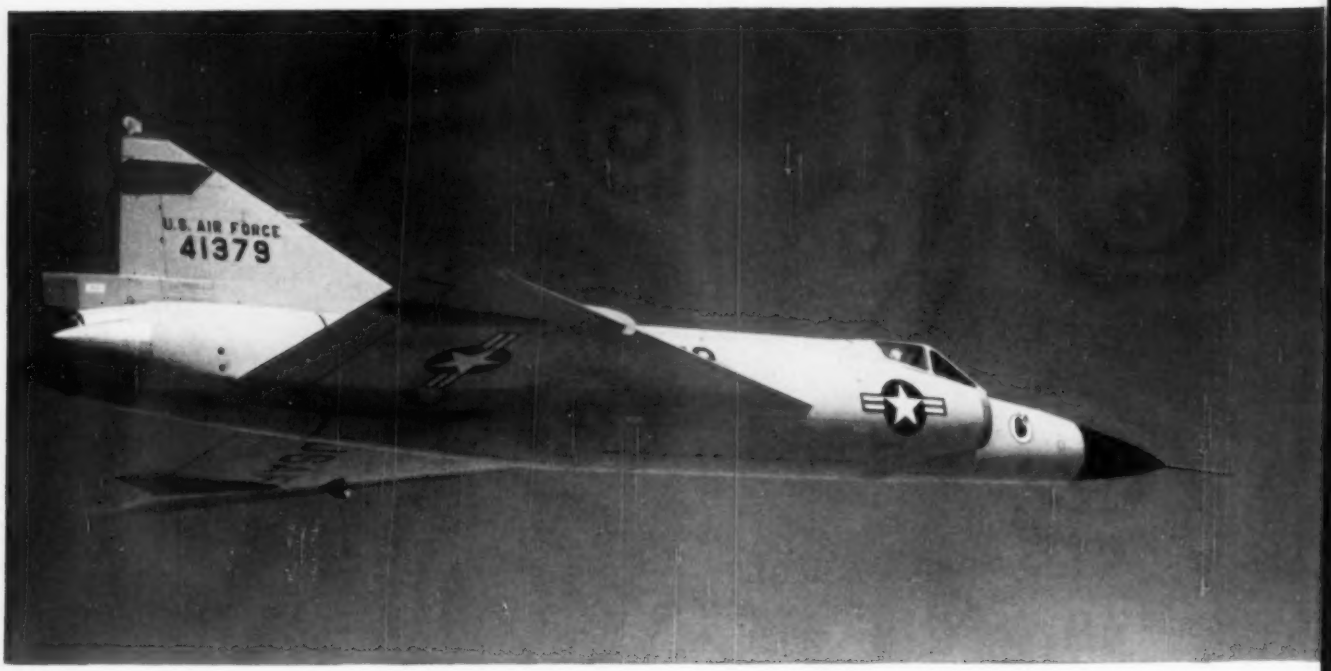
F6F HELLCATS *were the first Grumman Fighters flown by the original Blue Angels when formed in 1946.*

F8F BEARCATS, *being lighter, faster, and more powerful than the F6F, were the second Grumman fighters chosen by the Blue Angels.*

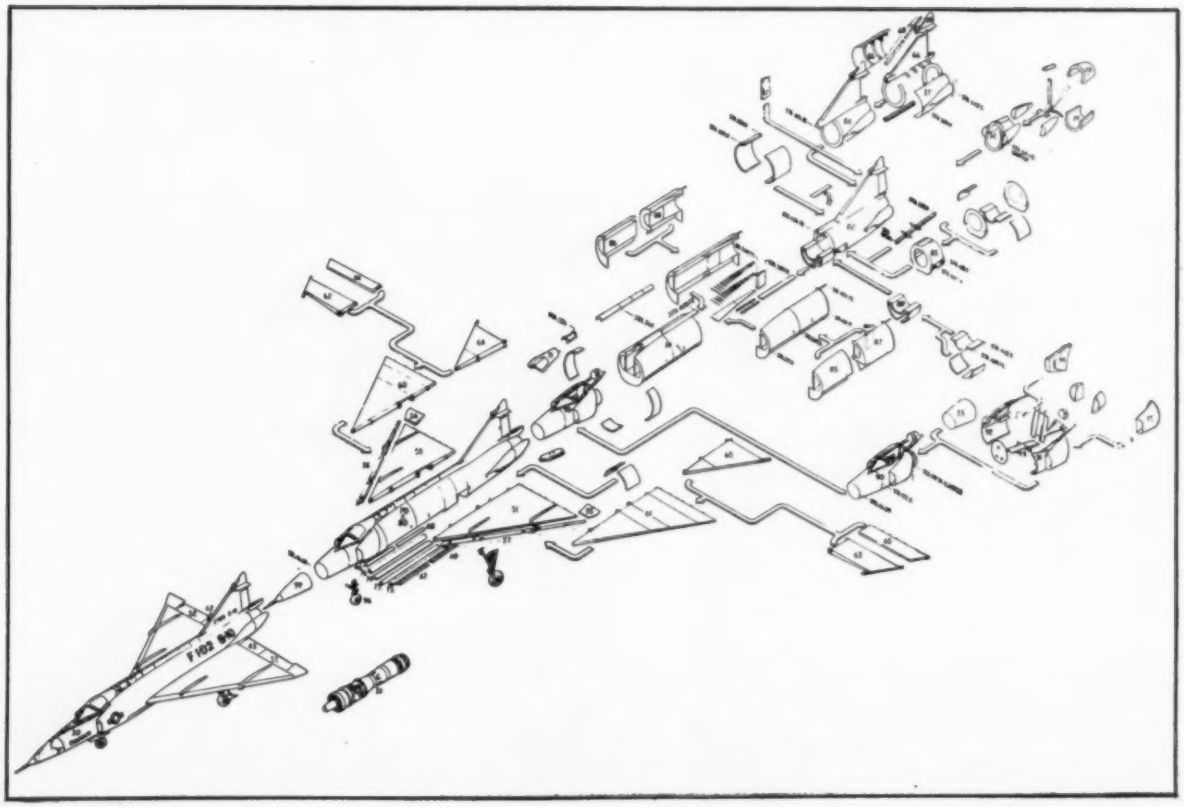


F9F-2 PANTHERS *became the first Blue Angel jet fighters in 1949. In 1952 they transferred to the faster F9F-5's.*

F9F-8 COUGARS *are the latest Grumman jet fighters being flown by the famous Navy Flight Demonstration Team.*



F-102A Pioneers Production Concept



By David A. Anderton

San Diego—Convair's F-102A is the first end product of a different kind of production cycle.

It was the first airplane to be ordered by the Air Force under its Cook-Craigie production plan (AW, April 12, 1954, p. 13) calling for a slow initial rate of production parallel to an intensive airplane test program. This concept was aimed at working the bugs out of a new design before hundreds had been built.

The plan also called for complete high-production tooling of the airplane. This was the gamble; it was to pay off if the airplane was a good one and ordered in quantity. In that case, factory output could be accelerated swiftly and smoothly to a high rate in a minimum time.

To build the F-102, Convair management called in A. P. Higgins, chief tool engineer from the Fort Worth plant, made him works manager of San Diego Plant 2, and gave him a green light. Within 16 months after the move into the empty acres of Plant 2, the first production airplane rolled out of the huge doors.

Delivery On Time

"We hit the first delivery date right on the head," said Higgins, "and we haven't missed one since. The whole idea of the line was to deliver a complete airplane to the Air Force, ready to fight. We're not quite there yet but we are delivering about an 80% weapon."

About 90 of these supersonic all-weather interceptors have been cleared for flight at the company's facility at Palmdale. Right now production is matching the tooling rate and the transfer of some component subassembly lines around the factory floor.

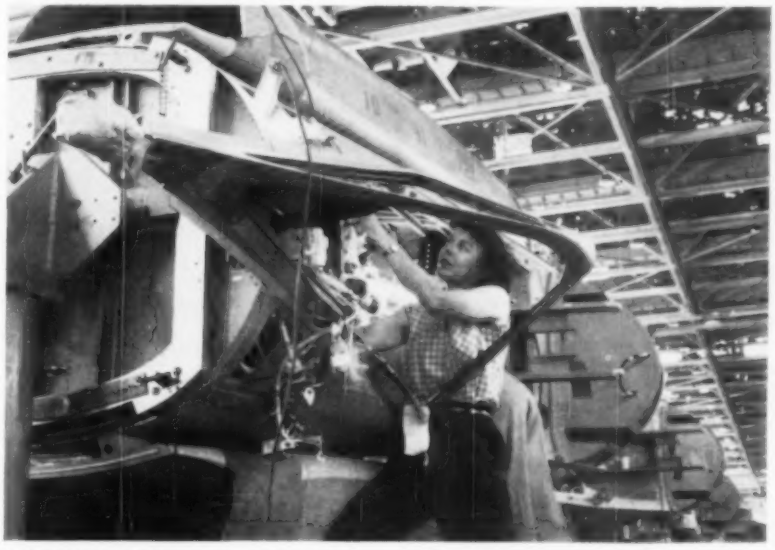
Latest USAF award to the San Diego plant is for production of the F-102B, a more powerful version of the interceptor aimed at matching the operational altitude capability of the Russian Bison long-range bomber. Powerplant of the B series will be the Pratt & Whitney J75, rated in the 15,000-lb. thrust class.

Phasing in of B production has already begun in Plant 2 where areas have been roped off and tooling begun.

Contract for production of the F-102B presumably will include a number of TF-102Bs. This brings to five the total number of production orders for the delta-winged craft. Three of these four include numbers of TF-102A trainers as well as the F-102A interceptors.

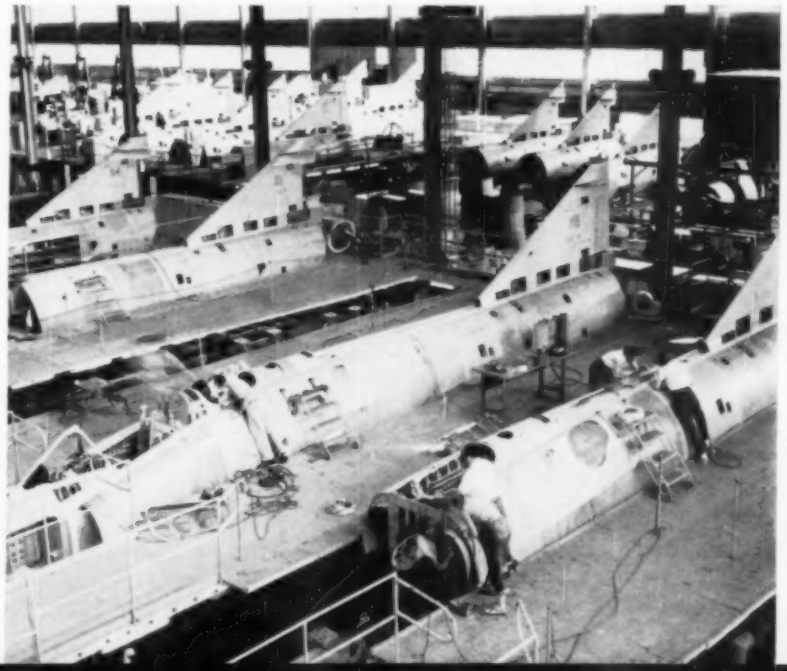
By late summer of this year, the production line will be at its full scheduled capacity, and production of the F-102B will be phasing in. In the event of a national emergency, production could

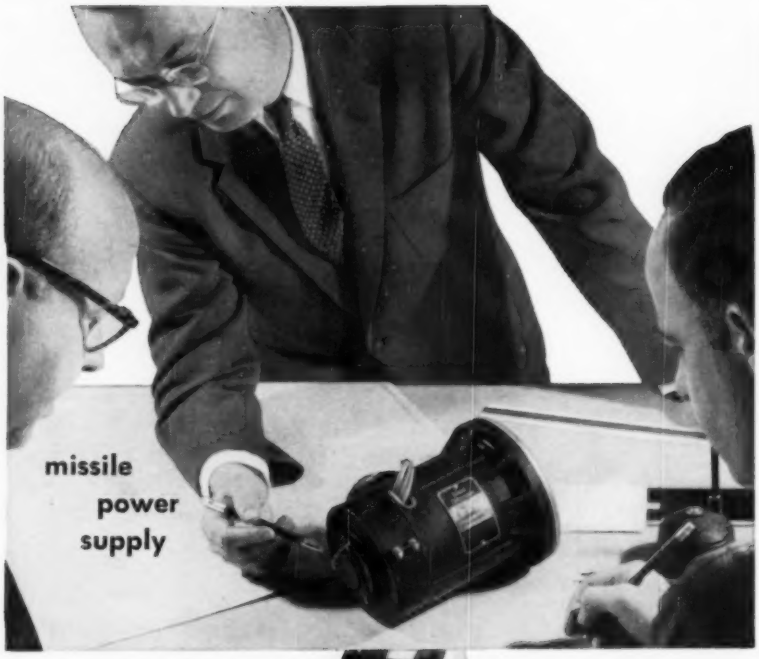
MERRY-GO-ROUND for F-102A pilot compartments move the assemblies from station to station so that skilled workers can install the complex details. Workers stay fixed.



HALF-SHELL fuselage sections take first form on these fixtures.

AIRPLANE FINAL assembly is done on this mobile production line. Completed fuselages start at far end, wings and powerplants are installed as the line moves toward the front of the picture. Line is mechanized, travels at a slow rate along the factory floor.





From "board" to production in 3 months

Weighing only 19 pounds and developing 5 KVA at 24,000 RPM, the guided missile alternator shown above went from drafting board to prototype production in just three months! It's another example of the proven design and production capability of Leland's Aircraft Products Division.

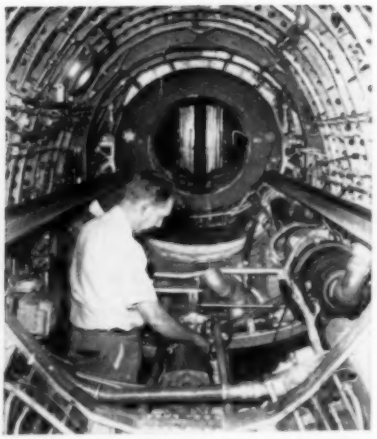
Among other missile power products developed and produced by Leland are the following Inverters: SE 16-2, 250 VA; MGE 45-1, 750 VA; SE 9-1, 2500 VA, and—for the Martin Matador, the SE 24-1, 2250 VA Inverter. There are others, too, but *security regulations* prevent us from mentioning them.

Missile power supplies are Leland's business. If you have *any* power problem that needs a solution, write, wire, or phone our Aircraft Products Sales Department now.

• DESIGN ENGINEERS.
If you would like a position with a group that is *really* performing in this growing field, one which recognizes and rewards personal contributions, then contact immediately Mr. J. E. Mulheim, Chief Engineer.

Another AMF Product
LELAND AIRCRAFT PRODUCTS

THE LELAND ELECTRIC COMPANY
Dayton 1, Ohio
Division of AMERICAN MACHINE & FOUNDRY COMPANY



WIRING and other accessories are installed more easily because of rotating assembly plan.

be further accelerated to turn out ten of the planes every eight-hour shift at this one location only.

Recontoured, Re-engineered

Convair production people got a break when the F-102 had to be redesigned. The original airplane, with its short nose and tubby fuselage, had been designed to meet a specification. Its production layout was a conventional one in which large chunks of the airplane were built and the systems installed later.

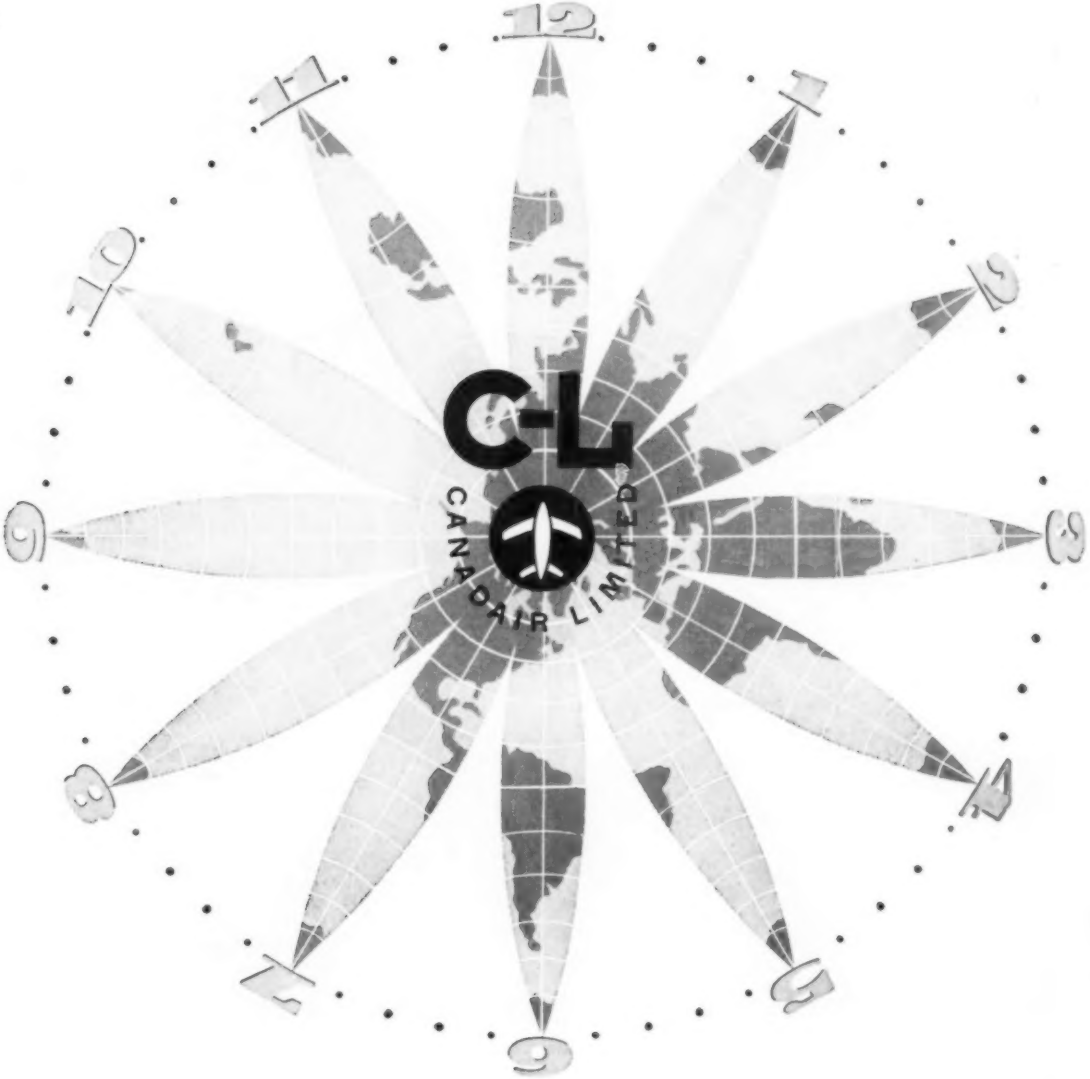
But transonic drag rise proved too much for the F-102 to hurdle and its fuselage had to be recontoured according to the area rule.

"Right here is one place where the Cook-Craigie plan really proved its worth," Higgins said. "If we'd been producing airplanes under old concepts, we'd have had 300 that didn't meet specifications instead of the 12 we did have."

When the F-102 had to be reworked, Higgins and his production people collaborated with the engineering department at a design level, and they planned the airplane and tooling together. Thus the final result was a production man's dream as well as a design engineer's vision.

One example of how this worked out: maintenance of some of the airplane systems of the original F-102 could only be done by pulling the engine. In the F-102A, the systems can be reached through the wheel wells and missile bays without hauling out the powerplant.

Higgins' basic idea was to break down the airplane into subassemblies small enough to be handled easily and large enough to utilize maximum manpower. Each of these sections was to be delivered to the final assembly line in as completely finished a stage as possible, with wiring, piping, valves, instrumen-



ON CALL ...around the clock ...around the world

There are approximately 2000 Canadair-built aircraft in civilian and military service around the world. Wherever they fly, their operators know that Canadair's personal service on operational or maintenance problems is quickly available. Canadair technical representatives, at present based on four continents, are always on call . . . and as dedicated to the Canadair ideal of sales service as a family physician is to the needs of his townfolk.

These men have come from all parts of the world . . from all spheres of aviation. They have been selected for their extensive knowledge of maintenance problems and for their specialized experience on the equipment in their charge. Their work is supplemented by aircraft systems trainers at the operator's own base; service repair and overhaul groups at the main Canadair plant, and a continuous flow of manuals, handbooks and bulletins. Around the clock and around the world, service is a continuing obligation to Canadair.

C-L **CANADAIR**

LIMITED, MONTREAL, CANADA

AIRCRAFT MANUFACTURERS

A subsidiary of GENERAL DYNAMICS CORPORATION, New York, N.Y.—Washington, D.C.

CANADAIR HAS BUILT MORE JET AIRCRAFT THAN ANY OTHER CANADIAN MANUFACTURER

F4D Skyray . . . Navy's Sunday Punch!

The Navy's F4D Skyray — newest all-weather fleet interceptor — gets its deadly sting from its Westinghouse Aero 13 armament control system.

Visibility good, or zero — when a Navy pilot is searching out enemy targets in a Douglas F4D, a blip on his Aero 13 radarscope shows him where the invading planes are. He selects the appropriate target and locks on, tracking. The Aero 13 computer calculates the proper attack course (at the pilot's option) until the target is in range. Directed by the Aero 13, the weapons are fired at the right instant — another intercept mission is accomplished!

The Aero 13 embodies advanced design for convenience of installation and maintenance, by cylindrical packaging, which is adaptable for the nose of any modern high-speed fighter aircraft. It consists of hinged panels which can be swung outward and downward for quick maintenance.

Each panel section in turn contains removable subassemblies. Complete circuits can be checked with test

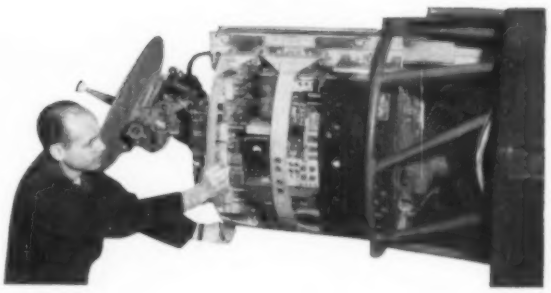
U. S. Navy Photo

equipment similar to an ordinary tube tester. Built-in test points in the radar subassemblies provide quick localizing of trouble.

Latest in the Air Arm fire control series, the Aero 13 is a refinement of an earlier Westinghouse development that scored the first blind kill of an enemy aircraft over Korea. It is one more example of creative engineering by Westinghouse — airborne defense systems to keep America free.

For assistance in specific fields of airborne electronics defense systems, contact Westinghouse Electric Corporation, Air Arm Division, Friendship International Airport, Baltimore 27, Md.

J-91049



The Aero 13 incorporates the complete radar and computing system in a unique barrel-type package which fits perfectly in the nose of the aircraft. Overhead slide-rail mounting provides easy pull-out for service.

The Air Arm Systems Family

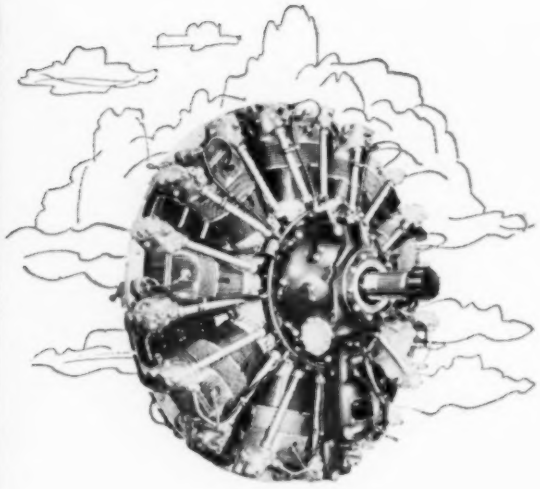
Fighter Armament	Bomber Defense	Flight Control
Missile Guidance	Special Purpose	Systems Components

WATCH WESTINGHOUSE!

*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU***

THE OKANAGAN GROUP

doubles payload capacity with new Curtiss-Wright Cyclone 9-Powered SIKORSKY S-58 "Aerial Packhorse"



Again this year, the Okanagan Group expands to meet Canada's growing needs for non-scheduled helicopter charter service. Since 1947, Okanagan has played an increasingly important role in Canada's fast-growing economy—transporting men and materials from the Atlantic west to the Pacific, from Toronto north to the Parry Islands.

In 1956 Okanagan will add at least four new helicopters, including a Sikorsky S-58 "Aerial Packhorse." Powered with the dependable 1525-horsepower Curtiss-Wright Cyclone 9 engine, the S-58 can handle a 3,000 lb. payload — double the capacity of any other Okanagan helicopter. It means that more companies can reach into the most rugged terrains of Canada — bring out more of her natural resources and materials, contribute further to her continuing growth.

The Curtiss-Wright Cyclone 9 is a powerplant built for the rough work of Canada's mountains and forests. It has proved itself in commercial operation all over the world. Over 113,000 Cyclone 9s have already been built, and the demand continues. The Cyclone 9 has been chosen for many leading helicopter models because it means faster, more dependable performance under the toughest of flying conditions.

YOUNG MEN! JOIN THE U. S. AIR FORCE

Investigate Career Opportunities
At Your Nearest Recruiting Office

WRIGHT AERONAUTICAL DIVISION
CURTISS-WRIGHT
CORPORATION • WOOD-RIDGE, N. J.

World's Finest Aircraft Engines

LANDING GEAR DOOR area is trimmed by router attachments on huge wing trim and bore fixture designed by Convair tool engineers. Engineers laid out a sequencing chart scheduling operations.

CONVAIR-DESIGNED this huge machine to trim wing leading edges and landing gear well area, bore and ream landing gear attach fittings. Operator controls passes of leading-edge trimmer.

tation and all other systems in place and functionally checked.

Next step was to develop estimates of the times required to build each of these subassemblies and the number of stations required on each line. This resulted in a master schedule and sequence of operations, laid out on a huge sheet of cardboard. "That represents about 10,000 man-hours," Higgins said as he pointed to the sequencing chart. "And it's saved us many times that in producing the airplane."

With a final delivery date fixed by terms of the contract, Convair production design and tooling engineers were able to work backwards, taking the finished airplane apart mentally and on paper to wind up at the beginning of the production cycle.

From that sequence of operations the engineers were able to get complete phasing of all the tooling for details and assemblies. They could find the tooling times and assembly times for the ultimate production rate. They could advise the engineering department on the order in which to release shop drawings and ease some of the problems of that kind of scheduling.

There was one drawback. The sequence of operations showed that work would have to start before Plant 2 was ready. Tooling had to be activated in the fall of 1952 to meet the delivery date.

With no plant, no tools and no facilities, Higgins turned to Fort Worth and Plant 1 at San Diego as well as to outside sources for his first tooling work. After January, 1953, when Plant 2 began to take on a semblance of life, an increasing percentage of tooling stayed inside its doors.

"There's one point I want to make about our tooling," Higgins said. "We see tool engineering as a service organization whose major interest must be in producing airplanes, not building tools."

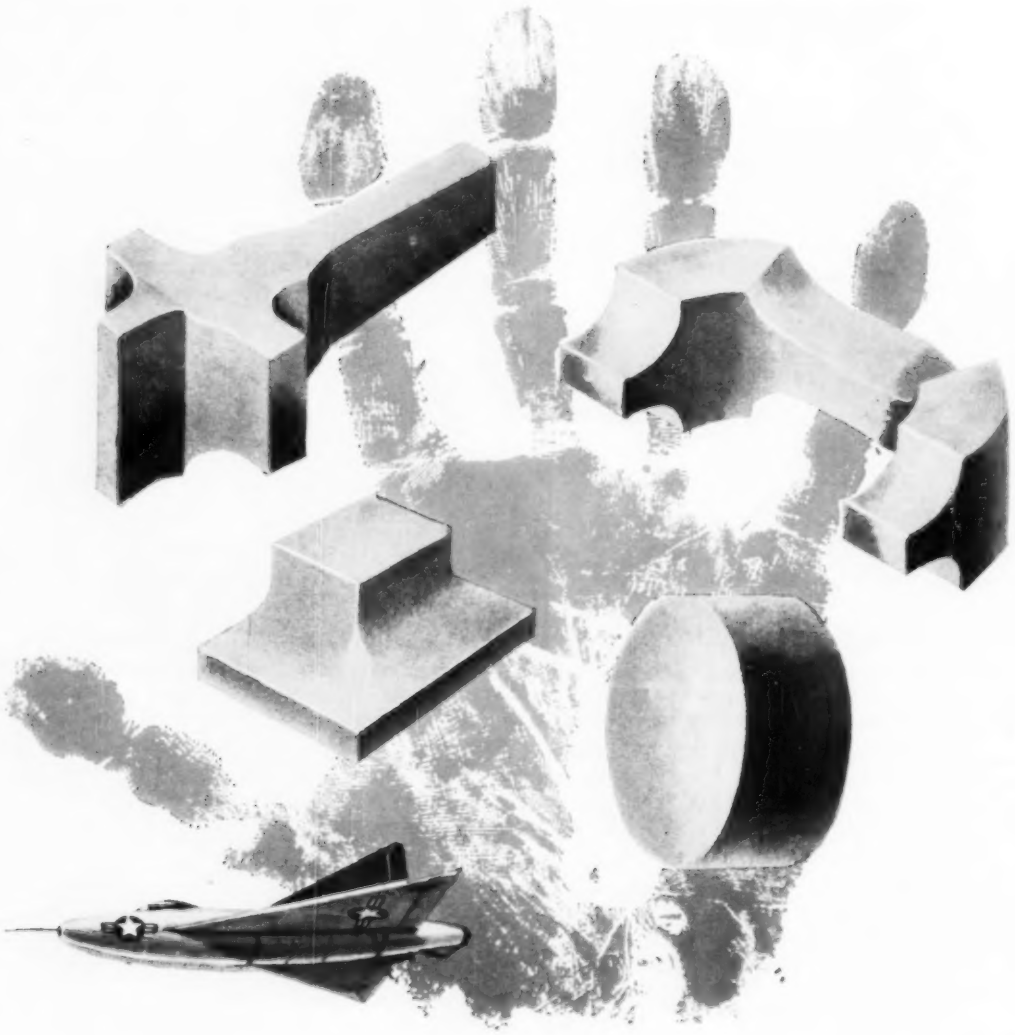
New Plane, New Ideas

A batch of new ideas guided the production of the F-102A. Other production lines had been mechanized; other airplanes had used the half-shell construction; other designs would call for forgings from the heavy press program. But no other airplane had yet combined all these features and many others into its production plan.

Even the traditionally cumbersome part number system was simplified for stock routing; the part number was related to the using department so that a detail piece could get to its proper station anywhere in the plant and only three numbers would be needed to route it.

All components and hardware except

WING PRIMARY line starts with complete basic structure panel. Other wing components are added along the lines. Men at left foreground are installing the segments of the cambered leading edge. Wings move toward rear as they are completed.



BRIDGEPORT ALUMINUM HAND FORGINGS
Available from 5 to 2000 pounds

Considering hand forgings for your experimental or prototype job?

Bridgeport can deliver a wide variety of shapes in sizes ranging from 5 to 2000 pounds. Count on fast production and prompt service, too . . . since Bridgeport maintains a complete stock of forging alloys. Complete heat-treating and annealing facilities are also available to develop the physical properties you require. And the very latest in ultrasonic test equipment guarantees shapes that are free from internal defects.

Take advantage of Bridgeport's complete production facilities for your hand-forging requirements. They're your assurance of top quality, unmatched service and prompt delivery.

For particulars, send for your copy of four-page bulletin which explains Bridgeport's many services and facilities.

For the very newest in

BRIDGEPORT ALUMINUM Bridgeport

EXTRUSIONS, DIE AND HAND FORGINGS

Bridgeport Brass Company, Aluminum Division, Bridgeport 2, Connecticut • Offices in Principal Cities

for a few high-dollar and GFAE parts are line-stocked in bins next to the station at which they are to be assembled.

These items are now produced in sets of 50, but with the buildup to full-scale production that number will go up to 150.

Fuselage Line

On the fuselage line, the first major chunks of the F-102A are the cockpit side panels, conventionally built of frames and stringers. These closely spaced members are both riveted and Scotchwelded together. The latter process is a technique for bonding metal by using adhesive in tape form rather than as a liquid to be brushed on.

Next come the duct inlets, rugged structures fabricated in small fixtures. Recently the inlet itself was modified by the addition of a separator plate sticking ahead of the original inlet face. This is known in the shop as the "buzz fix" because its primary purpose is to eliminate a high-frequency buzzing of the fuselage side panels during flight.

The inlets and side panels are moved to a nose fixture where they are joined to the floor panel and the forward and rear bulkheads.

This pilot compartment basic assembly next goes to the "merry-go-round," a series of movable fixtures which take the unit in a rotatable mount. As the cockpit makes its round, all its primary systems are installed: control linkages, throttle quadrant, rudder pedals, tubing and wiring. The windshield frame is added near the end of the line, and with the addition of the radar bay the nose is completed.

The center section of the fuselage—called the "barrel"—is made in four sections: front and rear, left and right half-shells. They start as half-bulkheads, left and right, held in separated fixtures for easy assembly.

All riveted joints in the barrel are sealed before skinning to prevent air leakage from the fuselage into the boundary layer of the airplane.

Internal Joinings

These half-bulkheads are skinned inside and out, and then taken to separated fuselage bucks to make left and right halves. Joining of the internal systems is done here; the fuselage halves are joined at the next station.

Engine mount fittings, shroud and tail cone, are titanium. The shroud is an unusual assembly of waffle skin seamwelded over light rings. The skin is a vendor item; the rings are hat sections, formed on a Cyril Bath Contour Former.

In a parallel set of fixtures and by parallel methods, the rear barrel of the fuselage takes form. It is made of fore and aft shell assemblies. The aft shell is built from light metal bulkheads in halves.

The forward section is built around heavy press-forged bulkheads.

Mating of these two sections takes place on a fixture where primary installations also are begun.

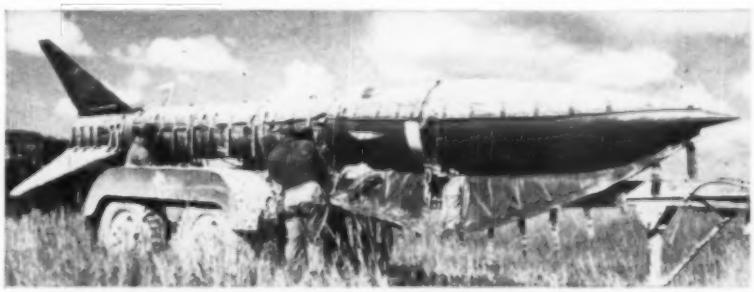
The fuselage final assembly line then receives the three major subassemblies: the completed nose section—either for an F- or a TF-102A—the center barrel and the rear fuselage complete with vertical tail.

When the fuselage leaves its line for airplane final, it is complete. The rudder has been installed and the control system checked. Antennas are mounted, the cockpit is fitted. Everything but the actual installation of the black boxes has been done along the production line.

Building the Delta

Basic wing panel structure consists of two tanks, one forward and one aft of the landing gear well. The wing is broken for assembly at the well, so that a complete wing consists of left and right panels, each made of a forward and aft tank section, plus the other components, such as leading edges, fences and elevons.

These tank sections start off as eight sculptured skins which are set up in fix-



THERMAL CONDITIONING OF ROCKETS AND GUIDED MISSILES

HEATING OPTICAL, ELECTRONIC, OR HYDRAULIC AIRBORNE EQUIPMENT

WHERE CAN YOU USE
G-E SPECIALTY HEATING EQUIPMENT?

Whenever your equipment requires thermal conditioning, General Electric specialty heating equipment can help.

G. E. has had extensive design and manufacturing experience in providing controlled heating for a wide variety of applications. These applications range from giant guided missile blankets to tiny one-inch long accelerometer heaters. Problems of intricate shape, large or small size, unusual environmental conditions, and amount of heat required have all been solved.

LET US ANALYSE YOUR HEATING PROBLEM; a General Electric specialty heating expert is available and a prompt answer is assured.

FOR MORE INFORMATION contact your General Electric Aviation and Defense Industries Sales Office or send coupon.

General Electric Company
Section C220-10, Schenectady 5, N. Y.

Please send me new bulletin GEA-6285, G-E Specialty Heating Equipment.

☐ for immediate project
☐ for reference only

Name .....
Position .....
Company .....
City ..... State .....

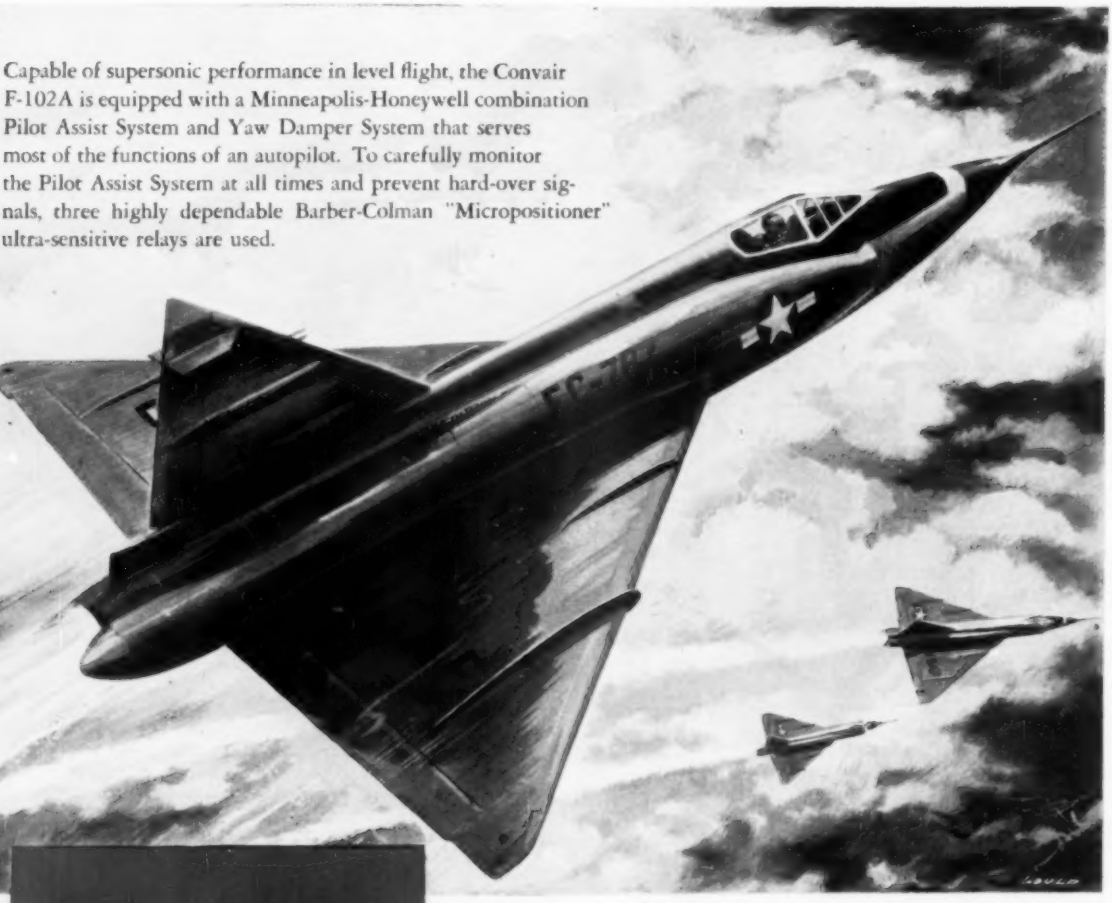
GENERAL ELECTRIC

BARBER COLMAN

Aircraft Controls

chosen as components in F-102A pilot assist system

Capable of supersonic performance in level flight, the Convair F-102A is equipped with a Minneapolis-Honeywell combination Pilot Assist System and Yaw Damper System that serves most of the functions of an autopilot. To carefully monitor the Pilot Assist System at all times and prevent hard-over signals, three highly dependable Barber-Colman "Micropositioner" ultra-sensitive relays are used.



Three Barber-Colman "Micropositioners" are used in roll and pitch synchronization and heading engage networks of the amplifier-calibrator portion of the F-102A Pilot Assist System, shown above.

This application is just one of the many in which the aircraft industry uses Barber-Colman "Micropositioner" ultra-sensitive relays for precision control. These polarized relays operate on input powers of 50 microwatts to 1 milliwatt and are available in a wide selection of coils, enclosures, mountings.

The complete line of Barber-Colman aircraft controls includes: Actuators; Positioning Controls; Temperature Controls; Small Motors; Valves; Ultra-Sensitive Relays; Thermo-Sensitive Elements. Write for literature or consult the Barber-Colman engineering sales office nearest you: Los Angeles; Seattle; Baltimore; New York; Montreal; Melbourne.

Barber-Colman Company

DEPT. F, 1422 ROCK STREET, ROCKFORD, ILLINOIS

AIRCRAFT CONTROLS • AUTOMATIC CONTROLS • INDUSTRIAL INSTRUMENTS • SMALL MOTORS • AIR DISTRIBUTION PRODUCTS
OVERDOORS AND OPERATORS • MOLDED PRODUCTS • METAL CUTTING TOOLS • MACHINE TOOLS • TEXTILE MACHINERY

tures and drilled to templates. These finished skins are joined to wing ribs in another fixture. Wing spars are attached next in the process.

Before skinning, the flying surfaces are smeared with a sealant.

Quality control during the wing manufacturing is strict because the F-102A has integral tanks. "And we haven't had a single tank leak in the two and one-half years we've been flying," said Higgins.

Part of this fuel-tight quality is credited to the Straylor rivet developed at Convair.

This rivet is flat under the head where the conventional countersunk rivet has a conical surface. Before insertion, the riveter puts a 0.005-in. thick pure aluminum washer under the head as a gasket.

After riveting, the wing tanks are baked at 320F to bond the sealant. From this station, the wing sections are placed in a fixture for pressure checking. With access doors buttoned down, the tank is pressurized to 7.5 psi to check for leakage.

Primary Structure

A vertical fixture takes these components and the wing trailing edge assembly for mating into a complete primary structure panel. This panel is moved to a special machining fixture designed by Convair engineers.

Visualize a large triangular framework big enough to take two of these panels, side by side, with the root chords about at floor level. The huge steel pipes forming the fixture make a right triangle with the wing foot chord horizontal and the trailing edge vertical.

Along the hypotenuse is a bed for a miller which trims the leading edges of the wing spar to precise dimensions. On each side opposite the landing gear wells is a combination router and borer, which trims the landing gear wells and bores and reams the landing gear attach fittings.

Wing Interchange

After the boring operation for the wing-fuselage attachment fittings, the wing panels go to the wing primary line for completion and installation of the systems.

On this line, wing leading edges, elevons, fences, landing gear and doors, wiring and tubing are installed.

When the wing leaves the far end of the line, it is a complete unit, checked out functionally and ready to go on an airplane.

"Another thing about those wings," Higgins said, "They really are interchangeable. We figure that if a pilot damages a wing he can be fighting again with that airplane within 24 hours after he lands for repairs. We've had two belly landings, and in both of them we

At Your Service... Hydrospin

A few of the typical shapes of metal parts which have been Hydrospun.

Take Advantage of This Power Spinning Process and Cut Your Manufacturing Costs

A Cincinnati Hydrospin machine is now in operation at Kaiser Metal Products, Inc., and is available to missile, jet engine and other manufacturers for development and production work.

Under high compressive forces, rollers form an inexpensive flat blank or simple preform to the shape of a rotating mandrel, usually completing a part in one pass. Movement of the roller brackets is controlled by hydraulic tracer and makes possible irregular wall thickness and curved wall shapes. Strength characteristics are improved and finish is excellent.

Savings Take Many Forms

Forming by this economical method obsoletes many chip cutting operations with resulting savings in labor, material and machines. One manufacturer has made savings of 100 lbs. of critical high temperature alloy in one jet engine part alone. Another development on a missile part shows savings of 40% in material over draw die method and saves weight of the finished part by control of wall thickness.

A wide range of metals has been successfully Hydrospun and, as the above photograph shows, an unlimited variety of tubular, conical and hemispherical shapes is possible. Ask us about ways to put this Hydrospin to work for you in solving your manufacturing problems on hard-to-make, highly stressed parts. We can show you how to produce a better part at a definite cost saving. Write for brochure today. Address Dept. A.

This Cincinnati Hydrospin, one of the few now in operation, may be the answer to your production problems.

Design Engineers: Take advantage of controlled wall thickness possible by this process and consider redesign for ultimate strength and weight savings.

KAISER METAL PRODUCTS, INC.
BRISTOL, PA.

Rocket Powered Targets for Pushbutton Marksmen

Realistic targets for today's advanced weapons systems must be as fleet and maneuverable as the potential opponents they simulate. Small, speedy, remotely controlled drones can give pilots and gunnery crews the combat training they require.

Powerplants to propel drones at transonic and supersonic speeds represent another important area for the application of the advanced technology resulting from *RMI POWER ENGINEERING.*

Rocket power to drive missiles and piloted aircraft higher and faster has been the prime product of RMI since its inception 15 years ago. Today, as the oldest company in the rocket engine field, Reaction Motors has a wealth of experience gained in the design and production of engines for record-holding vehicles of both types.

Engineers and Scientists: creative and rewarding opportunities exist for all types of technical specialists in the research, development and production of rocket power devices. Send complete resume and salary requirements to employment manager.

PRIMARY AND AUXILIARY ROCKET POWER FOR: Missile Boosters and Sustainers, Aircraft, Target Drones, Ordnance Rockets, Ejection Systems, Launching Devices.

Power for Progress

RMI

REACTION MOTORS, INC.

A MEMBER OF THE OMAR TEAM

DENVILLE, NEW JERSEY

also checked the tanks afterwards. There weren't any leaks in the intact wing."

Wing and fuselage assemblies start down a moving production line, picking up components as they go along. At several stations of the line, red lights atop stanchions blink the warning that power is on in the aircraft for its systems check. Along this line, complete systems are operated, cycled through several runs to check installations. The radome and the long pitot boom are installed.

Engines Arrive

Along the rear of the line come the Pratt & Whitney J57s that power the F-102A, gripped in rolling horizontal fixtures.

The engine is slid into the fuselage, the tail cone buttoned on, and the airplane is about complete.

At the end of the moving line, the finished airplane is lifted off and placed on a specially designed truck trailer for transport to the old gun butts adjacent to the flight line. There, final preparations are made for the flyaway to Palmdale for flight tests and delivery to the USAF.

Right now, the plane is painted in the San Diego plant, in a spray booth that takes up precious room on the factory floor. Ultimately the painting will be done at Palmdale. The F-102A will fly there in its St. Patrick's Day prime coat.

A separate section of the plant houses all-metal mockups which serve dual purposes as engineering and tooling aids. One major value of the mockups is in utilization for layout of tubing and wiring harnesses, a job that hardly ever can be planned on paper. But by working with a dimensionally accurate metal mockup, skilled shop personnel can help designers to evolve the final form of the twisted viscera of the F-102A.

A section of the final assembly floor is reserved for the airplanes that will always be coming back for something special.

Currently a batch of TF-102A trainers are having their canopies reworked. The next time it might be some special weapons installations. But that space will always be there and ready.

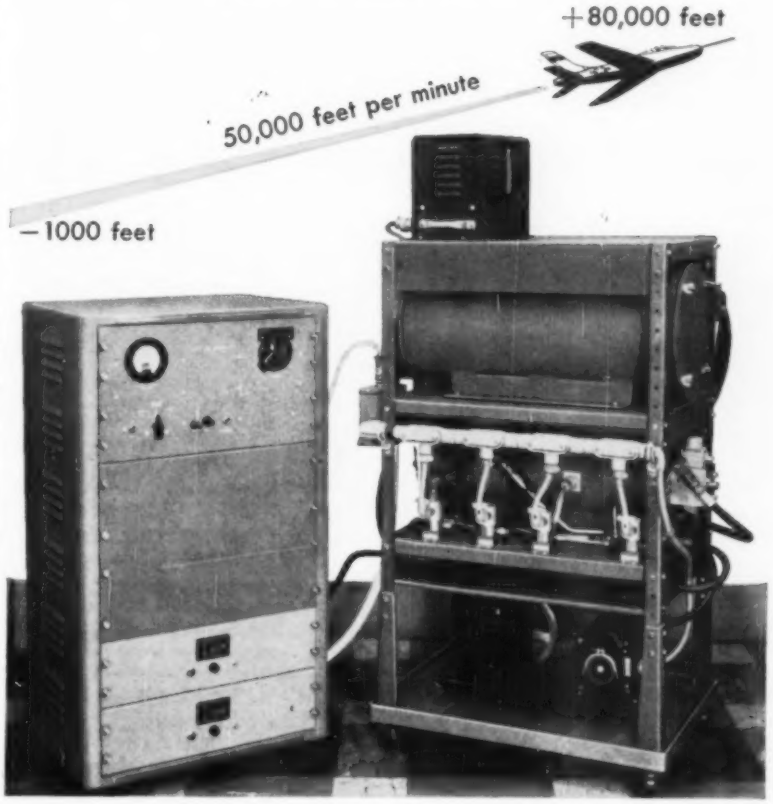
Cooperation on the F-102A

The success of San Diego in meeting deliveries reflects in large measure the work of many other subcontractors and vendors.

A big share of the component work is done by Convair plant at Fort Worth: missile bay doors, wing leading edges, elevons, vertical fins and rudders, complete radar compartments, aft fuselage half-shells, front and rear bulkheads and flooring for the pilot's compartment,

DYNAMIC ALTITUDE SIMULATOR

New!



Duplicating the altitude conditions of high performance aircraft and missiles, the hydraulically actuated CTI Dynamic Altitude Simulator makes possible laboratory evaluation of flight control equipment and instruments without the expense and delay involved in actual flight test. Capable of control by an analog computer, the unit reproduces pressure variations along a computed flight path.

SPECIFICATIONS

	PRESSURE*	ALTITUDE
Setting Range	15.23 to 0.403 psia	−1000 to +80,000 feet
Bandwidth	±0.35 psi	±700 feet
Threshold	0.0005 psi	1 foot
Rate of Change, Max.	25 psi per minute	50,000 feet per minute
Threshold Rate of Change	0.0125 psi per minute	25 feet per minute

*At sea level (14.69 psia) with 100 cubic inches in unit under test. A smaller volume results in greater bandwidth and maximum rate of change.

Frequency response, at sea level, cps	10
Test chamber dimensions	9-in. diameter by 24-in. long
Input power	220 v, 3 phase, 60 cps, 1 ½ hp 115 volt, 60 cps, 750 watts

ALSO AVAILABLE: THREE-AXIS FLIGHT SIMULATOR

Write for complete technical data on the above equipments.

CTI®

COLOR TELEVISION INCORPORATED

SAN CARLOS 6, CALIFORNIA

VITAL PROJECTS such as AERO-13 CHALLENGE YOU at Westinghouse BALTIMORE DIVISIONS

In the nose of the Douglas F4D Skyray fighter interceptor is the new Aero-13 Fire Control System developed by Electronics Engineers at Westinghouse—Baltimore Divisions. This improved system makes possible the detection and destruction of enemy aircraft under no-visibility weather conditions. (Photo courtesy Douglas Aircraft Company, Inc.)

The development of this System is but one of a series of challenging projects in airborne, ground and shipboard electronic systems that offer the electronics engineer the true growth potential so important for a real future. Your career at the Westinghouse Baltimore Divisions will be one of unlimited opportunities—including opportunities for work on advanced projects, and opportunities to continue your education toward advanced degrees at the company's expense. If you are interested in this type of career, Westinghouse is interested in you!

ADVANCED EDUCATION AT COMPANY EXPENSE

Westinghouse encourages its electronics engineers to continue their education toward both M.S. and Ph.D. degrees. The company pays all tuition expenses.

Current Openings EXIST IN THE FIELDS OF:

CIRCUITRY
MICROWAVES
SERVOMECHANISMS
MAGNETIC AMPLIFIERS
DIGITAL COMPUTER PROGRAMMING
FIRE CONTROL SYSTEMS
OPTICS
PACKAGING
TRANSFORMERS
ANALOG COMPUTER DESIGN
TECHNICAL WRITING
VIBRATION
RADAR DESIGN
FIELD SERVICE
INFRARED TECHNIQUES
COMMUNICATIONS
ANTENNAS

TO APPLY

Send resume of education and experience to:
Technical Director, Dept. 327
Westinghouse Electric Corp.
Friendship Airport
Baltimore, Maryland

WATCH Westinghouse

Where big things are happening every day!

and the complete nose for the TF-102A.

The fire control system for the F-102A, without which it would be just another airplane, is a Hughes Aircraft development.

Convair engineers praise the close relationship with their Hughes counterparts as one of the biggest factors in producing a fighting airplane.

Other major contributors to the production program include Menasco, manufacturing the complete landing gear; Goodyear at Phoenix, supplying the windshield, canopy and fin tip; Rheem, making the titanium fuselage tail cone section; and Narmco, delivering the rudder.

Costs Low

Convair's labor force on the F-102A and TF-102A now totals about 7,000 direct and indirect. They work two standard eight-hour shifts on a five-day week. A third shift is used in critical production areas as they develop.

"This could turn out to be the cheapest airplane on overall costs yet," said Higgins. "By delivering a complete weapon, we get the learning curve values racked up a bit by all the installations work we do. But if you look at the total cost chargeable to an airplane before it's delivered to the service as a weapon—not just at the time it rolls out the factory doors—we think we stand a good chance of delivering the lowest-cost airplane yet."

New Firebee to Fly Above 50,000 Ft.

A new high altitude version of the Firebee jet drone, designated the XQ-2B, will be built and flight tested by the Ryan Aeronautical Company. The Air Force contract requires the new Firebee to operate at altitudes in excess of 50,000 ft. and at high subsonic speeds. The Q-2A Firebee now in production operates at altitudes up to 40,000 ft.

The new drone will be a modified version of the Q-2A incorporating these features:

- **An improved control** system with automatic climb and dive features and glide control.
- **A re-designed wing** with approximately one-third more area, increased span and a revised leading edge.
- **A Fairchild FT-101-D-1** turbojet engine of 1,000 lb. thrust. This is a commercial version of the Fairchild J-44-R-20 now being used in Navy KDA-1 Firebees.

High speed wind tunnel tests of a one sixth scale model and flight tests will round out the eight-month XQ-2B program.

Flight testing is scheduled to begin at Holloman Air Development Center this summer.

Cave, Water Head Cut Air Flow Cost

Stockholm—Large air flows for combustion chamber research on jet engines have been obtained at a tremendous saving in installed power and a 50% saving in operating costs by Flygmotor Aeroengine Company at Trollhatten, Sweden.

The trick is an 11,000-cu.-yd. chamber blasted into rock for storage of compressed air, plus the pressure head of a column of water tapped in from a nearby river.

This air magazine is charged by three two-stage reciprocating compressors in parallel, driven by electric motors with a total power of 745 hp. This is said to be about one-thirtieth the installed power that would be required to deliver the same air flows directly into the test rigs without the magazine.

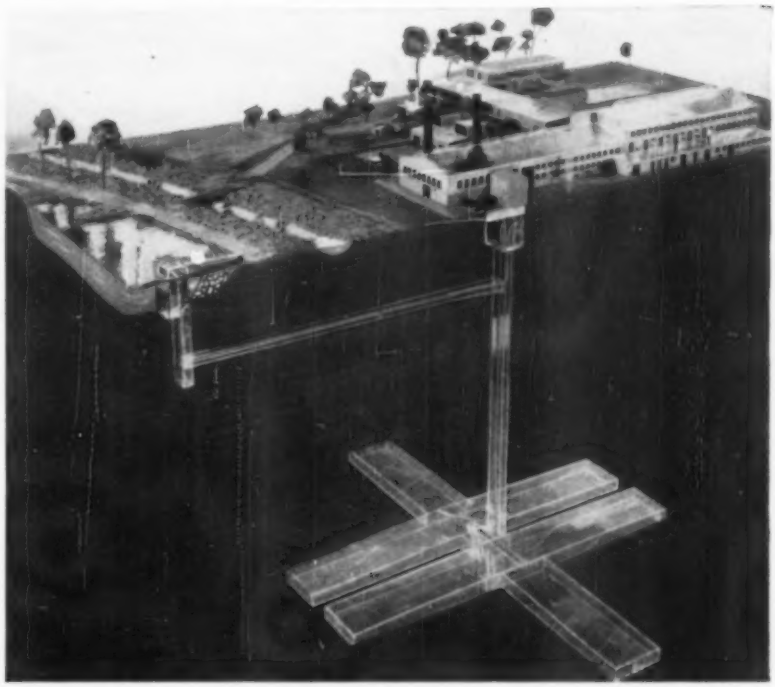
Capacity: 130 Tons

It takes 17 hr. to charge the magazine to its capacity of 130 tons of air. (Charging compressors deliver 2.15 kg per sec.) If required, the compressors can be run day and night, giving a total of 175 tons of air per 24 hr. The air capacity can be increased to 230 tons per 24 hr. by addition of another compressor for which space is provided.

Cost for each filling (17 hr.) is $5. Another cost schedule shows that one ton of air delivered at rigs costs about $1.40 in this plant against $2.80 in a steam plant of similar capacity.

Cost $240,000

Cost of building the magazine system (including water tunnel, piping systems, compressors) was $240,000, of which nearly $200,000 was for excavating.



CUTAWAY MODEL of Swedish jet engine research plant shows 11,000 cu. yd. air storage magazine (lower right) and tap for water pressure head in river.

The plant has been in use for four years, and all figures are based on this experience, not on calculations.

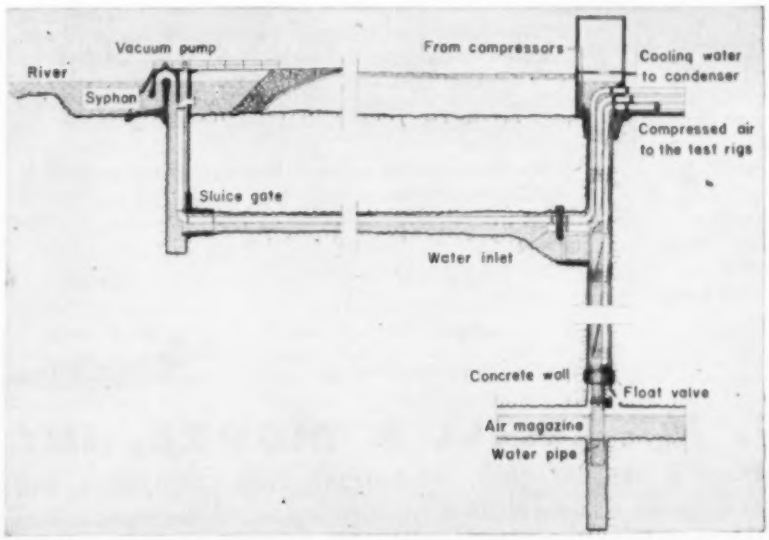
The system delivers a maximum pressure of 9.5 atmospheres and airflows up to 250 kg per sec. The main disadvantage of the plant is the limited testing time at large air flows. Time available varies from 90 min. at nominal air flows (ca. 25 kg/sec.) to 40 min. at 50 kg/sec. and on down to 10 min. at 250 kg/sec.

However this disadvantage has been offset to a great extent by equipping the test rigs with rapid-recording instruments.

The layout of the underground chambers is shown by the cross-section drawing.

Photo of a model gives a scaled presentation of the system.

The chamber is 85 meters below the normal level of the adjacent river. The height of the chamber is only 3.8 meters, to reduce the pressure changes that result from different heads of water during a test.

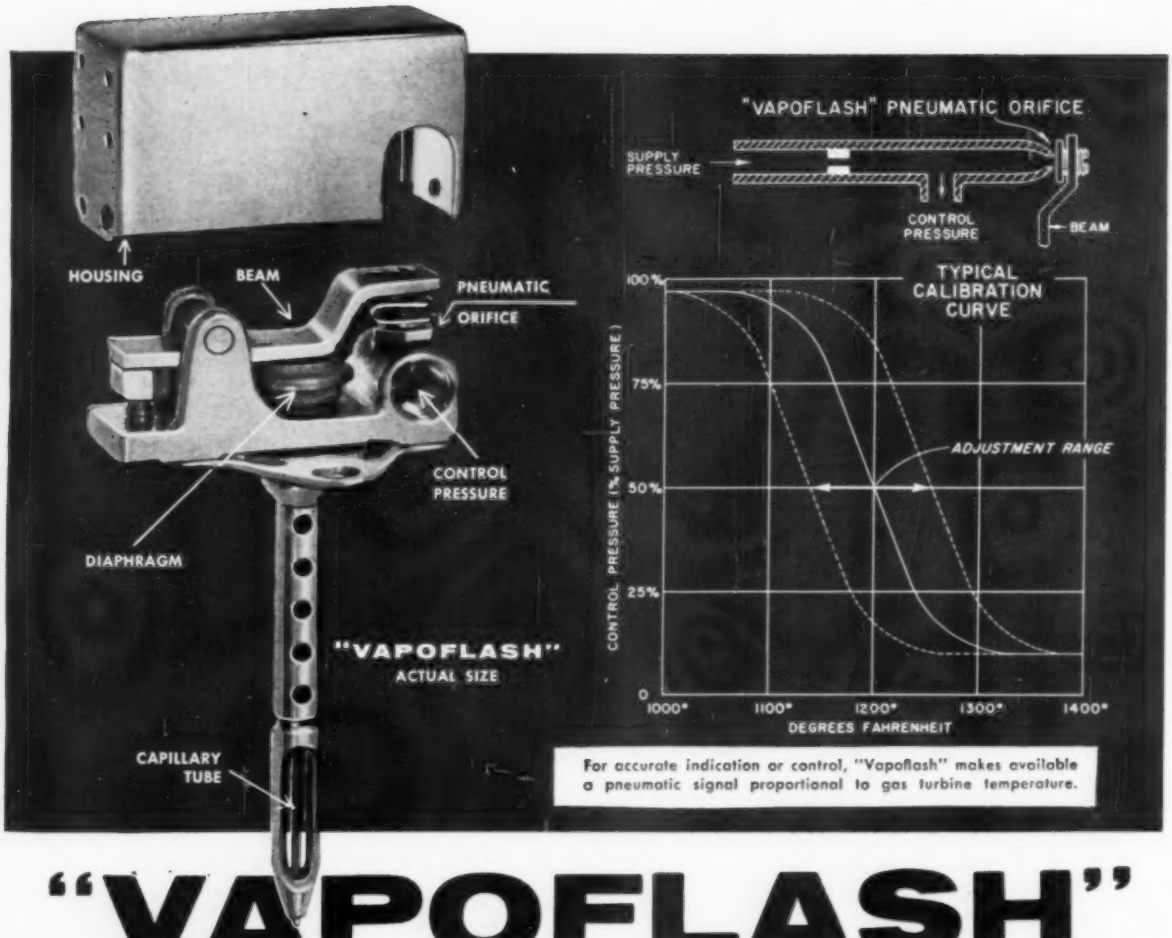


DETAILS of the water intake and air magazine systems are outlined in drawing.

Concrete Seal

When the magazine is discharging air, water is taken in from the river through a siphon intake. It travels through an 80-meter horizontal tunnel to a vertical tunnel down to the magazine. The vertical tunnel is sealed off with a concrete plug just above the roof of the magazine, and the water passes through a steel pipe in the plug down into a shaft below the floor of the magazine.

Thus the air is forced by the water against the roof and into a two-ft. diameter pipe in the vertical tunnel, and on to the laboratory pipeline system. The air system serves four large



"VAPOFLASH"

. . . an entirely new development in gas turbine control components

"Vapoflash" — a unique new measuring probe — provides the advantage of high-gain, pneumatic output. The power level of the control signal is such that greatly simplified mechanisms can be applied to modulate main engine and afterburner fuel flow, and the exhaust nozzle area of turbojet engines.

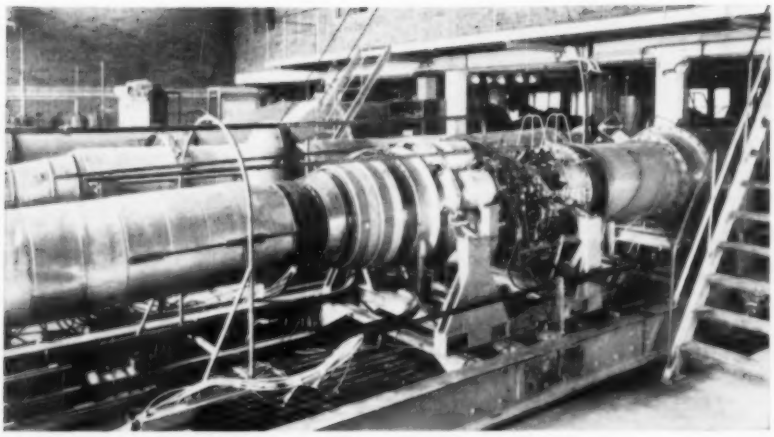
The accurately calibrated "Vapoflash" probe exposes a mercury-filled capillary tube to the gas stream of the jet engine. As the gas temperature rises to the control set point, the pressure of the vaporized mercury in the element develops a signal which is measured by a metal diaphragm. As the diaphragm moves, it actuates a preloaded cantilever beam which operates a pneumatic orifice. Compressor discharge pressure serves as supply pressure: adequate power is conveniently available for control actuation. With several "Vapoflash" units connected in parallel for averaging, reliable measurement and control of gas turbine temperatures is simplified.

We are confident that our long experience in developing, manufacturing and testing jet engine control components can be of practical service to you. Our engineering department will welcome the opportunity to analyze your control requirements.

MANNING, MAXWELL & MOORE, INC.

AIRCRAFT PRODUCTS DIVISION • DANBURY, CONN. • STRATFORD, CONN. • INGLEWOOD, CALIF.

OUR AIRCRAFT PRODUCTS INCLUDE: TURBOJET ENGINE TEMPERATURE CONTROL AMPLIFIERS • ELECTRONIC AMPLIFIERS PRESSURE SWITCHES FOR ROCKETS, JET ENGINE AND AIRFRAME APPLICATIONS • PRESSURE GAUGES THERMOCOUPLES • HYDRAULIC VALVES • JET ENGINE AFTERBURNER CONTROL SYSTEMS.



JET ENGINE is mounted on test rig at Flygmotor Aeroengine Company.

test rigs, seven small ones, and one supersonic wind tunnel.

(A separate boiler plant with steam turbine delivers 100 tons of steam per hr. to a compressor test rig.)

When the air magazine is being charged with air, the water is forced back into the river through the pipe which opens below the floor of the chamber.

When the water level reaches the floor of the chamber, the charging compressors are automatically shut off. In the same way, discharging of the magazine is automatically stopped when the water level reaches the roof of the magazine.

When the water in the magazine has risen to a certain level a warning lamp in each test rig indicates that all tests must be interrupted within a certain time.

The system includes a number of safety devices, including one which lets air into the siphon tunnel to stop the inflow of water should pressure mount above the capacity of the pipe system in the laboratories.

Russians Reveal Chief Designer Of Powerful Tu-104 Jet Engines

A Russian engineer, P. F. Zubets, whose name is relatively new to Western observers, has been officially proclaimed as the chief designer of the powerful jet engines in the Tu-104.

The powerplants are reported by a Polish source to be rated at 14,880 lb. sea level static thrust, which is derated 15% from their military counterparts that power the Badger medium bomber. Full military rating of the engine would therefore be 17,100 lb. thrust.

Zubets, interviewed in the Russian periodical Ogonek, credited work on the engines to three bureaus headed by F. A. Korotkov, L. F. Golgofskii and P. N. Tarasov, all chief design engineers. The first experimental engine was built at an experimental plant headed by Chief Engineer S. K. Tumanskii. Production engines are being turned out at two factories under the leadership of I. T. Borisov and A. D. Smirnov.

Kubets said the basic design philosophy was to build a high-power unit and use a minimum number of engines rather than to go to a larger number of smaller-thrust powerplants. He said that even bigger and more economical engines are being designed in the Soviet Union.

More performance data on the Tu-104 is quoted in a Polish magazine. The data apparently was given to a reporter during an interview with Andrei N. Tupolev, the designer of the newest Aeroflot transport.

Service between Moscow and Khabarovsk (4,040 mi.) with an intermediate stop at Novosibirsk is to be started soon by Aeroflot using the Tu-104. These performance figures were quoted:

• Maximum speed, 559 mph.; cruising speed at 32,800 ft., 497 mph.; range under ICAO conditions, 1,988 mi.; climb to 36,090 ft., 15 min.; maximum ceiling, 39,370 ft.; single-engine ceiling, 16,404 ft.

Dimensions for the Tu-104:

• Wingspan, 114 ft. 10 in.; length, 121 ft. 4¾ in.; height, 39 ft. 4¼ in.; wing area, 2,023.61 sq. ft.; aspect ratio, 6.5; fuel capacity, 8,970 U. S. gal.

First flight of the Tu-104 was on June 17, 1955; first public appearance was only a few weeks later at Tushino during the National Aviation Day show. It was built as a pre-production airplane rather than as a prototype.

New! PATTON oil seal puller

SAVE TIME— MONEY

PULLS DEAD-END BRONZE BUSHINGS, OIL SEALS, BEARING RACES

The new PATTON Puller does the job quickly and easily without damage to parts and castings. In addition, oil seals, bearing races and dead-end bronze bushings are removed in a fraction of the time formerly required.

The PATTON Pullers are available in complete sets to handle a range of sizes from ⅜" to 4½" or individual pullers may be supplied. Larger or special sizes can be custom made for specific requirements.

Originally designed for the Armed Forces, the PATTON Puller is now used in machine shops and maintenance and repair shops in the following industries: aviation, automotive, agriculture, construction, marine and oil fields. In fact, wherever machinery and equipment is repaired, PATTON Pullers save costly man hours and prevent unnecessary damage to component parts.

Write for complete descriptive literature.

PARTS LIST

PATTON NO.	AIR FORCE STOCK NO.	HEAD SIZE
PM-8001 (Set)	7900-573278	Comp. Set 7/16"-1 7/16"
PM-8051 (Set)	7900-573279	Comp. Set 1 11/32"-4 1/16"
PM-8001-1 assy.	7900-573265-5	5/16"-1 11/32"
PM-8001-2 assy.	7900-573265-75	9/16"-2 3/32"
PM-8001-3 assy.	7900-573266	15/16"-3 5/32"
PM-8001-4 assy.	7900-573266-25	2 1/32"-4 1/16"
PM-8001-5 assy.	7900-573266-5	1 3/32"-3 1/4"
PM-8001-6 assy.	7900-573266-75	1 11/32"-3 7/16"
PM-8051-3 assy.	7900-573267-5	1 29/32"-2"

Other Sizes Available

Pat. No. 2380068 and Patent Pending

PATTON MANUFACTURING CO., INC.
1802 West Pleasant St.
Springfield, Ohio

"Brain cells"

SEALED IN GLASS

This Raytheon flat press subminiature tube is about to be inserted in the pilot mechanism of a missile to help guide it to its target. Long-range radar that "sees" distant planes—precise automatic pilots that "fly" commercial aircraft—computers that "think" thousands of times a second: these are a few of the sensitive jobs aided by Raytheon tubes, transistors and diodes.

Today, there are more Raytheon subminiature tubes and transistors in use than those of any other manufacturer. Raytheon is also the world's largest manufacturer of magnetron and klystron microwave tubes.

Raytheon's record in designing reliable electronic products for home, industry and the armed forces is, in substantial part, due to its pre-eminence in tubes and transistors.

Excellence in Electronics

RAYTHEON

RAYTHEON MANUFACTURING COMPANY

WALTHAM 54, MASSACHUSETTS

PRODUCTION BRIEFING

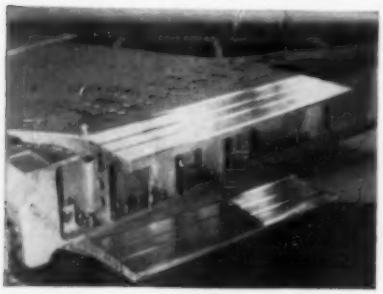
Fischer & Porter has completed its decentralization program with the establishment of an Instrument Division which will handle engineering, production and sales of recording, controlling and totalizing equipment and associated products. Address: 695 Jacksonville, Rd., Hatboro, Penna.

Misco Precision Casting Company, Whitehall, Mich., is constructing a new 85,000 sq. ft. plant in Muskegon, Mich. This addition will make the company, which is now producing gas turbine blades and vanes, the second largest producer of investment castings in the world.

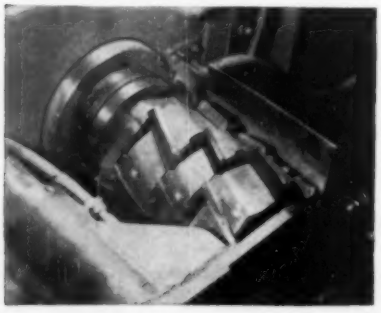
The Liquidometer Corp., Long Island City, N. Y., is building a new 4,500-sq.-ft. West Coast sales and engineering office, at Santa Monica Blvd. and Harper Ave., Los Angeles.

Hastings Plastics, Inc., Santa Monica, Calif., plans to manufacture and distribute a complete line of resins for electronic applications, low pressure laminating and plastic tooling.

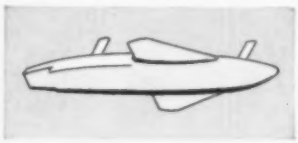
Induction Motors Corp., Long Island, is joining with Constructions-Electro-Mecaniques Tollim, Paris, to establish an international manufacturing and sales outlet for Induction's subfractional horsepower motors. The new company will be known as the Societe Francaise des Moteurs Induction.



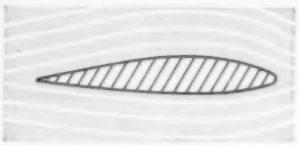
F-100 wing spar (top) joint milled with ganged cutter of the "Helicarb" design (bottom) at North American Aircraft, El Segundo, Cal.



Even the hot desert sands offer no landing problems to aircraft whose design includes the Pantobase landing system. A product of Stroukoff research and development, Pantobase will permit landings and take-offs from snow, ice, sand, water and unimproved terrain; thereby extending the operational capabilities of the aircraft and reducing the need for conventional airports in many remote and previously inaccessible parts of the earth's surface.



Pantobase—When designed into an aircraft the Pantobase system enables the plane to land and take-off from many types of surface without changes or additional landing equipment.



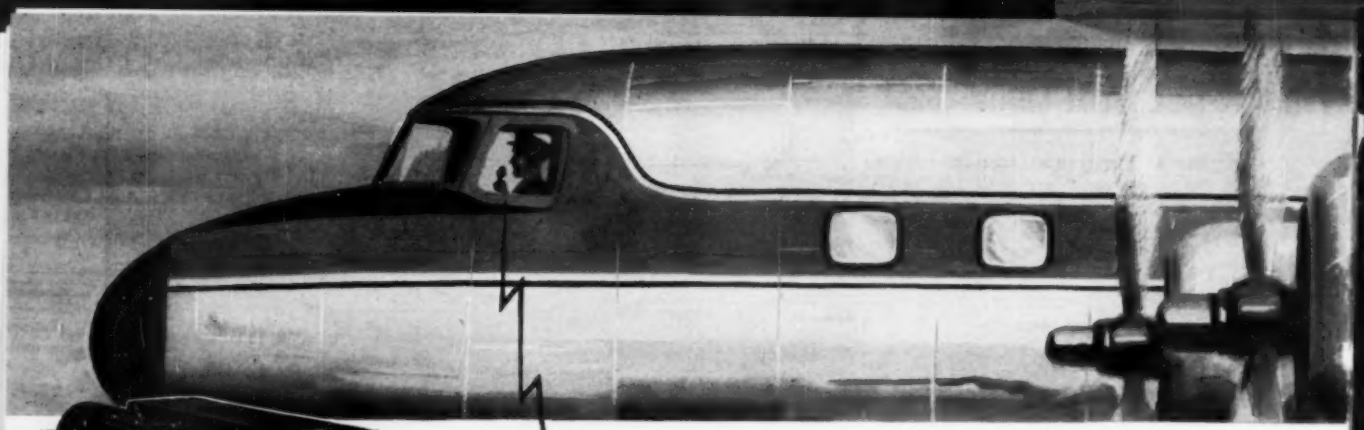
BLC-Boundary layer control as developed by Stroukoff increases the effective lift and delays stalling of the wing, thereby reducing required speeds and distances for take-offs and landings.

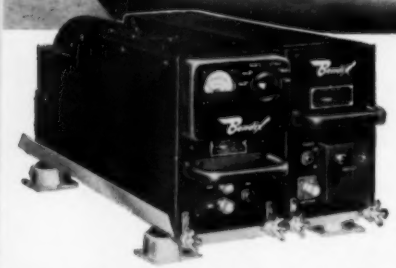
Achievement is a tradition at Stroukoff. A leader in the development and design of cargo and transport aircraft, Stroukoff offers challenging opportunities to creative engineers.

Extending the Frontiers STROUKOFF AVITRUC *of Aircraft Performance*

Stroukoff

WEST TRENTON, NEW JERSEY





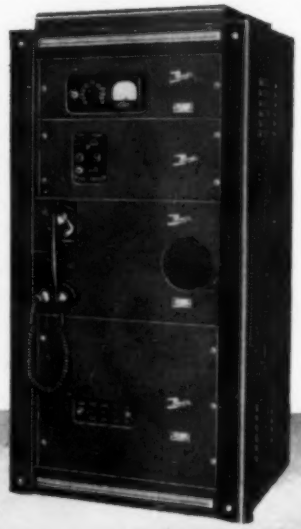
TA-20 TRANSMITTER, RA-18 RECEIVER

Each provides 360 crystal-controlled channels from 118.0 to 135.95 megacycles with 50 kilocycle channel spacing. Receiver: 3-microvolt sensitivity with carrier-operated squelch control. Transmitter: 25 watts minimum of r-f output power.

Nearest thing to Personal Contact!

RG-9 RECEIVER, TG-19 TRANSMITTER

Receiver: 118.0 to 135.9 megacycles. Single-channel operation with 50 kc channel separation. Transmitter: 108.0 to 135.9 megacycles. 50 watts r-f output power. Single channel with facilities for dual channel operation on output frequencies within 800 kc.



Bendix VHF Airborne-Ground Communications

The best way to talk to somebody is "in person." No question, then, about getting things straight. But, of course, it's out of the question in this age of travel.

The next best thing to do is to match this way of communicating as closely as you can. That's Bendix* VHF Airborne-Ground Communications.

The complete system consists of the RA-18 and TA-20 Airborne Receiver and Transmitter; and the RG-9 and TG-19 Ground Station Receiver and Transmitter. *Combined weight of the airborne units including power supplies is 49 lbs.*

TO DATE, 80% OF THE AIRLINES THAT HAVE CHANGED TO 360-CHANNEL OPERATION HAVE SPECIFIED BENDIX RA-18 RECEIVERS.

If you have a communications problem or are contemplating replacing your present equipment, we would like to present our story. Write us direct. Bendix Radio, Aviation Sales, Baltimore 4, Maryland.

*Reg. U.S. Pat. Off.

Bendix Radio

DIVISION OF BENDIX AVIATION CORPORATION

West Coast Sales: 10500 Magnolia Blvd., N. Hollywood, Calif.
Export Sales & Service:
Bendix International Division, 205 E. 42nd St., New York 17, N.Y., U. S. A.
Canadian Distributor: Aviation Electric, Ltd., 200 Laurentian Blvd., Montreal, Que.

New Auto-Navigator Corrects Itself

By Philip J. Klass

A new airborne auto-navigator, a dead reckoning device which automatically and continuously corrects itself from omnirange or other ground based radio aids or radars when it determines that these signals are accurate, has been developed by Lear, Inc.

The system is called Self-Correcting Automatic Navigator, or SCAN for short. The novel way in which SCAN combines dead reckoning and external radio signals gives greater accuracy than that available from either type alone, Lear says.

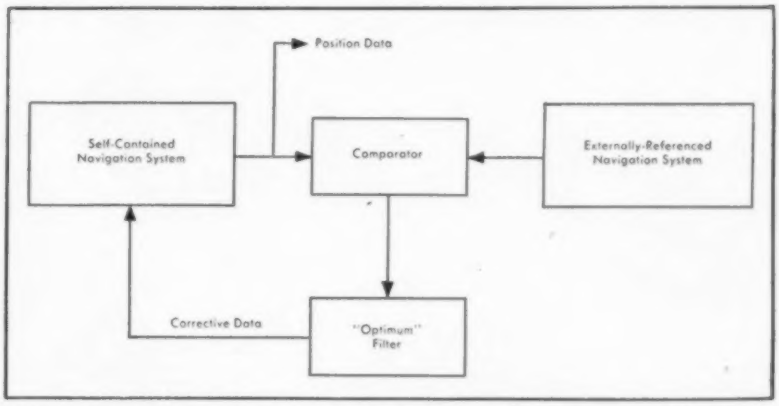
Compact Size

The Lear SCAN, which the firm says can be packaged in a small one-half ATR-size case, holds promise for a variety of airspace users. For instance, SCAN should enable:

- **Military aircraft** to operate beyond the range of line-of-sight navigation aids (such as VOR, Tacan) for low-level bombing in mountainous terrain, or over enemy areas where radar-silence must be observed, or enemy jamming is a potential hazard.
- **Airline-business aircraft** to operate off-airways flights into areas which do not have complete VOR coverage.
- **Helicopters** to navigate at low altitudes where present line-of-sight navigation aids are spotty in their coverage.

The SCAN development appears particularly significant in view of Air Force plans to make increased use of dead-reckoning computers for off-airways flying, a philosophy which the Air Force believes offers many advantages for civil use. In the event of war, a SCAN type of auto-navigator might be used by airliners and civil aircraft to make it possible to operate VOR/DME on an intermittent basis to prevent enemy bombers from homing on such navigation aids.

The concept of using an external reference, such as a VOR or automatic direction finder fix, to correct a dead reckoning computer and thereby improve its accuracy is not in itself new. The idea was discussed in a paper delivered by Hugh J. Galbraith of the Wright Air Development Center at the East Coast Conference on Aeronautical and Navigational Electronics last fall. (The paper was based on work and ideas contributed by Nathaniel Braverman, Hans Giesecke, Dr. C. C. Goldman, S. Knemeyer, and N. L. Laschever, all of WADC.)



LEAR SCAN (Self Correcting Automatic Navigator) uses signals from ground-based radio aids to correct automatically self-contained dead-reckoning or inertial guidance system.

A similar concept, is employed in some current hybrid inertial guidance systems (a form of dead reckoning) now under development, as described in AVIATION WEEK's series on inertial guidance. (Jan. 23, p. 76.)

Problem Choice

The real problem in combining aircraft position data obtained from two different sources is to determine which to believe. This is like the problem of determining the correct time from two clocks which are in disagreement.

Lear has developed a technique which, the firm says, will enable SCAN automatically to evaluate and weigh the creditability of navigation data obtained from a VOR or other ground aids.

Where creditability is high, the radio signal is used to correct DR-computed aircraft position, with its relative weight being proportional to its creditability.

These techniques for evaluating the reasonableness of external signals involve the use of information theory and statistical techniques similar to those recently developed for use in radio communications to combat poor signal-to-noise conditions. Lear has applied for patents on the basic SCAN techniques.

Basic DR Computer

There are a variety of pure automatic dead-reckoning systems which have been developed by a number of companies for the USAF and Navy. Although these differ in design sophistication and accuracy, they all operate in the same basic fashion, performing automatically the same operations that a pilot or navigator uses to establish his position by dead reckoning.

Signals proportional to true airspeed and aircraft magnetic heading are supplied automatically and continuously to the DR computer. From these the computer calculates how far and in what direction the aircraft has moved in the air. To convert this air position into ground position, the pilot sets into the computer the estimated wind velocity and direction, together with magnetic variation which enables the computer to convert from magnetic to true heading.

In the simplest of automatic DR systems, the pilot gets a continuous cockpit display of his distance and bearing to his starting point. In more sophisticated systems, the pilot may set in the bearing and distance from starting point to destination, in which case the computer can display bearing and distance to the destination.

Present Limitations

The inherent computational error of an automatic DR computer is only 1 or 2% of the distance traveled, but, more serious errors result because wind velocity and direction seldom are known with great accuracy for the full flight duration. In addition to these errors, there are other which arise from instrumentation errors in the true airspeed and heading sensing devices.

Thus, the basically simple, reliable automatic DR computer does not enable the pilot to pin-point his position, particularly during later phases of a long mission, because of the cumulative build-up of errors.

Ground radio aids also have certain limitations. VOR and Tacan are

Saves 40% Space!

STRONGER, TOO

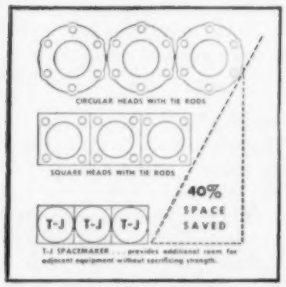
Than Outmoded
Tie Rod Cylinders!

Only T-J

Spacemaker
CYLINDERS

Offer All The Extras As Standard!

- NEW *exclusive* Ingenious Cushion Designs . . . Super Cushion Flexible Seals for Air . . . New Self-Aligning Master Oil Cushion
- Compact design eliminates tie rods, saves up to 40% space
- Proven Performance . . . with Extra High Safety Factor
- Hard Chrome Plated Bodies and Piston Rods (Standard, at no extra cost)
- OIL pressure up to 750—AIR to 200 P.S.I.



NEW LITERATURE . . . send today for new Bulletin with complete details of Spacemaker line.

You'll find many answers to *automation* in your plant with T-J Spacemaker Cylinders! Designed with years-ahead features for top performance and dependability. Wide range of styles, capacities . . . for all kinds of push-pull-lift operations . . . reduces man-hours and costs! Write The Tomkins-Johnson Co., Jackson, Michigan.

MEMBER OF THE NATIONAL FLUID POWER ASSOCIATION

T-J TOMKINS-JOHNSON
VALVES · AIR AND HYDRAULIC CYLINDERS · CUTTERS · CLINCHERS

limited generally to line-of-sight distances. Even within this range there are occasional blind spots because of terrain, low altitudes, or at high altitudes near the ground station. Long-distance, low-frequency systems, as Navarho or Decca, may be subject to brief or prolonged service outage due to atmospherice disturbances, and/or increased errors in position fix at long distances from the station or in certain areas of coverage.

SCAN makes use of the fact that these shortcomings in dead reckoning computers and ground-based radio aids are complementary.

Checking Creditability

If the calculated position of an automatic DR computer can be checked continuously, or at periodic intervals, against a creditable ground-based radio navigation aid signal, the dead-reckoned position can be corrected to take out instrumentation errors as well as those resulting from differences between the estimated and actual wind drift encountered in flight. If the radio signal is lost, or becomes unusable for short periods, the DR computer could then go on calculating from the last known position, using the wind drift which existed at that time.

The technique which the Lear SCAN employs to check the all-important creditability of the external radio signal, to determine whether it should be used to correct the dead-reckoned position, can be illustrated in the following way.

Assume that an analysis of a DR computer's instrumentation errors, likely wind velocity and direction errors relative to the airplane's cruise speed indicate that there might be a total error of up to 5% in DR-computed position. If a SCAN-equipped 300-mph airplane takes off, its DR computer after four minutes might indicate that the airplane had traveled 20 miles due west. Because of previously cited instrumentation and windage errors, SCAN knows that there may be up to a one-mile error, so that the plane might be anywhere between 19 and 21 miles from its starting point.

SCAN then calculates airplane position using the signals from two VORs or one VOR and DME. If this shows that the aircraft is 19.5 mi. from its starting point, this one-half-mile discrepancy between DR and radio-aid computed position is within possible DR computer errors. SCAN would then accept the radio signal as creditable and re-correct its DR-computed position to show 19.5 miles instead of the original 20.

Suppose that four minutes later the DR computer establishes that the airplane is 39 miles west of its starting point. Because of cumulative DR errors since the last fix, the true airplane posi-

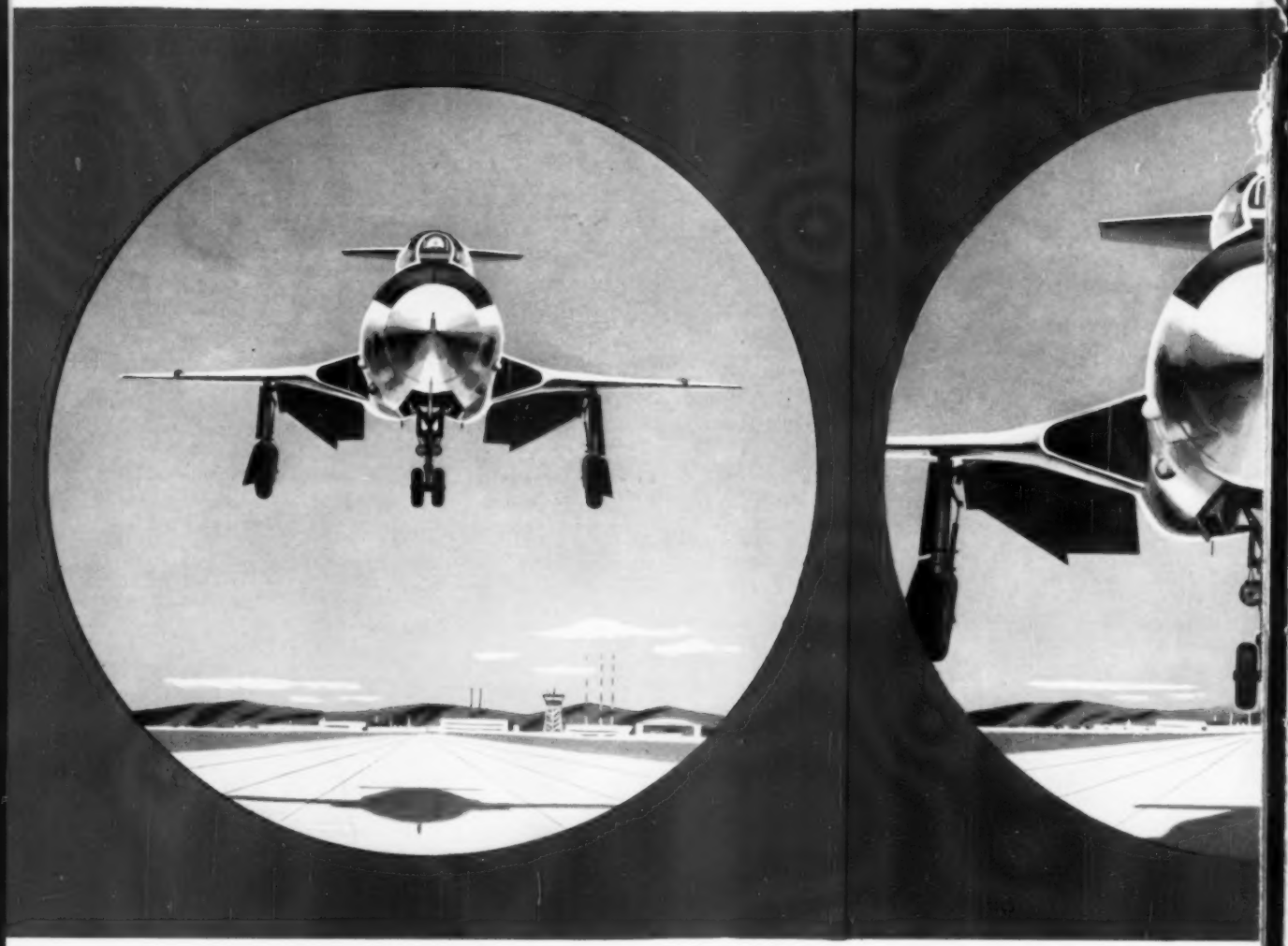
FORESIGHT— Northrop Aircraft's long-range vision is continuously focused on new horizons. Advanced planning by Northrop scientists, engineers and administrators has resulted in the development of formidable aerial weapons for our national safety. Among them are the atom-armed Northrop Snark SM-62s, first intercontinental missiles to be disclosed by the U.S. Air Force, and the Northrop Scorpion F-89 interceptors, lethal guardians of our defense perimeter. In addition, Radioplane Company, a Northrop subsidiary, has delivered over 40,000 pilotless aircraft for use by all branches of the military. At Northrop, today's goal is tomorrow's starting point. In this forward-looking spirit, Northrop is continually achieving scientific breakthroughs which contribute to our national progress and welfare.

NORTHROP

NORTHROP AIRCRAFT, INC. • HAWTHORNE, CALIFORNIA

Pioneers in All Weather and Pilotless Flight

AT THIS MOMENT



WHEN PRECISION COUNTS

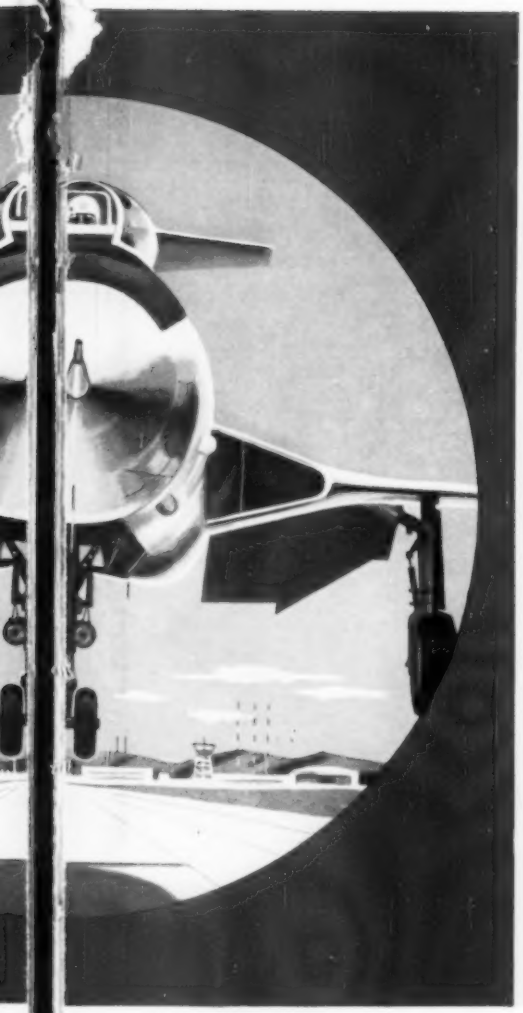
YOU CAN DEPEND ON GRUEN PRECISION

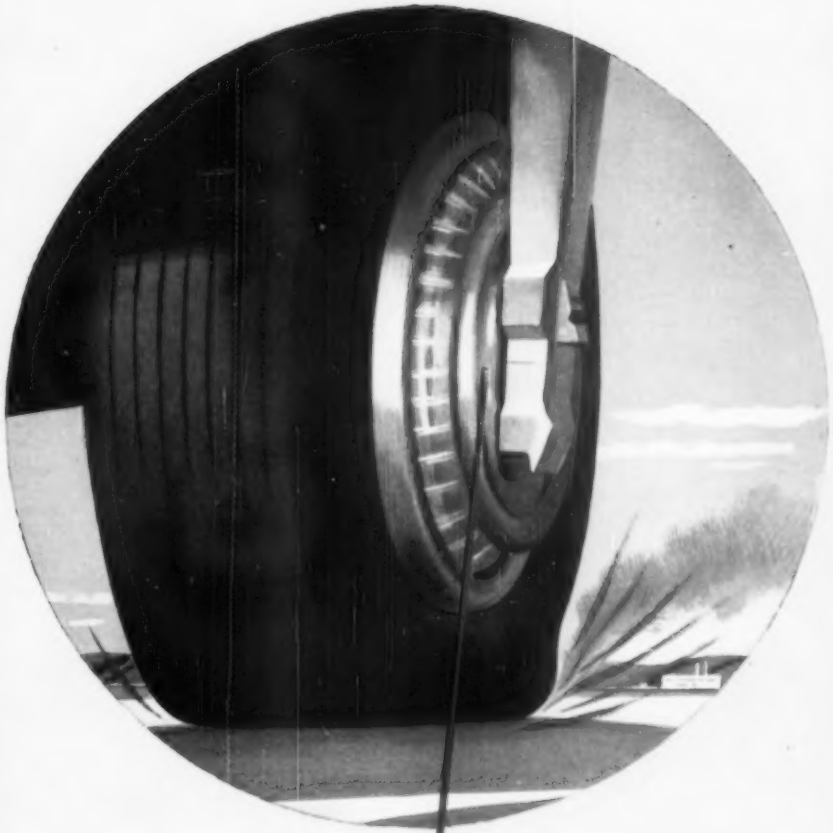
Flaps down...runway clear...speed 130 knots! This is the moment of touchdown! This is the moment when precision counts most!

MINISTOP by GRUEN—a precision part smaller in diameter than your fist—takes command at the instant of touchdown. Its precision electro-mechanical brain infallibly aids the pilot as he brings his aircraft to a smooth, gently rolling, skid-free stop. It's another example of Gruen precision you can depend on!

MINISTOP by GRUEN is no fair weather friend, either! It completely ignores blinding snow, slick rain, treacherous ice... performs with famous Gruen precision always! Stopping distance is

Whatever your products...whatever your problems..





MOST

reduced as much as 20%—automatically! The pilot is free to concentrate on other vital duties! Greater overall safety is assured!

MINISTOP by GRUEN is lower-priced, lighter and more compact than any other anti-skid device. Installation is easy and economical—maintenance practically nil. Tires take less punishment—last far longer. And the MINISTOP has been fully tested and proven under the most rugged conditions.

Made only by GRUEN in this country, MINISTOP is in use right now on leading aircraft throughout the world . . . increasing safety and comfort . . . decreasing operating costs. Could MINISTOP do the same for you? Why not contact us today and let our engineering staff give you the complete story.

THE MINISTOP by GRUEN

. . . world's lowest-priced, lightest, smallest, easiest to install anti-skid device. Another product of famous Gruen precision.

. . . when Precision Counts Most . . . You Can Depend On . . . .

. . . GRUEN PRECISION PRODUCTS

Gruen Precision Products (A Division Of The Gruen Watch Co.), Time Hill, Cincinnati 6, Ohio

TARGET . . . FLIGHT TEST

Soon, another product of Orenda's experience and imagination, a new turbojet of great power will enter its flight-testing phase.

Orenda turbojets also provide the power for all first-line fighter aircraft of the Royal Canadian Air Force in Canada and Europe — Avro CF-100s and Canadair Sabres.

Within a few months, Sabres powered by Orendas will go into service as the South African Air Force's first-line fighters.

ORENDA

ENGINES LIMITED

MALTON, CANADA

MEMBER: A. V. ROE CANADA & THE HAWKER SIDDELEY GROUP

Wave patterns interpreted from a wind tunnel photograph of the ORENDA arrow at 1800 miles an hour. Institute of Aero Physics, University of Toronto

tion may be 38 to 40 mi. west of the starting point. SCAN again computes aircraft position from the VOR/DME signals. Now suppose that these indicate the airplane is 42 miles west of its take-off point. This two-mile discrepancy indicates either that the aircraft has picked up a tail wind since the last corrected fix point, or that there are excessive errors in the VOR/DME signals.

Doubting Thomas

SCAN would temporarily remember this VOR/DME computed position, but would not use it to re-set its DR-computed position. A few moments later, SCAN re-computes aircraft position from the radio signals. If these again show a two-mile discrepancy, the creditability of the radio data grows. If repeated examinations of the radio signals shows consistency, then SCAN concludes that it is the DR-computed position which is in error, possibly due to a tail wind.

SCAN then would automatically crank into the DR computer a new value of tail wind sufficient to compensate for the previous error in DR computations, simultaneously changing the computer's output to indicate the correct airplane position.

In actual practice, the Lear SCAN makes the comparison between DR and radio aid-computed position continuously, when the latter is available. In this respect it can do a better job of checking creditability of input data than the human pilot, who ordinarily is too busy to make such comparative fixes except at irregular intervals. When they don't jibe, the pilot has to exercise his own judgment as to which to believe and this may be on a purely intuitive basis, whereas SCAN makes its judgments on a far-more scientific basis.

Creditability Factor

In practice, the Lear SCAN employs a much more sophisticated approach to the task of determining and actually weighting the creditability of external radio signals. If radio data is coming into SCAN on a continuous basis, any sudden, major discrepancies between DR-computed and VOR-computed position are sufficient cause for outright rejection of the radio signal data. If, on the other hand, radio data is available only at intervals of several minutes, greater discrepancies may exist without discrediting the radio data.

SCAN applies a weighting or creditability factor to such discrepancies that is a function of the magnitude of the discrepancy, the length of time since the last radio signal fix, and the inherent accuracies of the DR computer and particular radio navigation aid being used for external reference.

The Lear SCAN is designed to recognize quickly and accept radio data which shows small discrepancy from the DR-computed position, but to be slow to accept radio data which indicates large deviations, unless subsequent checks show a consistency of the radio data. However, even in the former case, the self-correction is introduced through integrators whose time constants are long compared to the data intervals so that even small deviation data must show consistency in order to be assimilated by the SCAN computer.

Jam-Proof

This characteristic makes SCAN relatively immune to enemy countermeasures, explained D. J. Green, Engineering Division manager of the Lear-Cal Division. Spurious or random radio data samples integrate out to zero because of the symmetry of Lear's data weighting function and the long learning-time constant used, Green said.

"The only possibility for an enemy to enter false information into SCAN would require extremely elaborate instrumentations," Green said. "With less elaborate countermeasures that do not saturate the (radio) receiver, the SCAN filtering technique will reach many decibels below the interference level to extract useful data. If sufficient jamming power is employed to

Now!...the NEW
ROBINSON WIRE TWISTER
with DIAGONAL GRIP-HEAD

Faster, more efficient than ever! The new, slendernose DIAGONAL GRIP-HEAD is designed especially for those narrow- hard-to-reach places. Split-second whirling action safety-wires 3 engines in time required for one by any other method . . . saves as much as $140 per engine assembled.

3-TOOLS-IN-1 . . pliers-cutters-twisters. Side-cutting, oil-tempered head. Permanent bronze bearing. No adjustments. Jaws lock on wire, can't slip off. Perfect, uniform twist every time.

12" —for assembly line safety wiring, 15 oz. $21.50
9" —for bench work, sub-assemblies, 12 oz. $20.50

Unconditional Money-Back Guarantee. Send for complete details.

RALPH C. ROBINSON CO.
Box 494W No. Sacramento 15, Calif.

Canadian Distributor, Gensales, Ltd., Malton, Ont.

MOOG
Servo Valves
Deliver
High Dynamic
Performance

Type . . . 4-way proportional, electro-hydraulic
Equivalent Time Constant . . . as low as 1½ milliseconds
Output Flows . . . 0.1 to 50.0 GPM
Control Currents . . . 2.0 to 40.0 milliamperes
Pressures . . . 1000 to 3000 PSI
Weight . . . as low as 11 ozs.
Maximum Dimensions . . . as low as 3.1" x 2.1" x 1.9"

MOOG

MOOG VALVE CO., INC.
EAST AURORA, N.Y.

hp Announces 2 all new OSCILLOSCOPES

-hp- 130A Low Frequency Oscilloscope

High sensitivity, dc to 300 KC. Sweeps 1 μsec/cm to 15 sec/cm.

-hp- 150A High Frequency Oscilloscope

Dc to 10 MC. Plug-in preamplifiers. Sweeps 0.02 μsec/cm to 15 sec/cm.

As a result of a totally new design philosophy, *-hp-* 130A and 150A Oscilloscopes set revolutionary standards for oscilloscope usefulness, convenience and rugged dependability. The instruments' wide versatility is indicated in the specifications at left. Their greater convenience and reliability is inherent in such unique features as: Universal automatic triggering system wherein one preset adjustment provides optimum triggering for almost all conditions. Unitized circuits, easily isolated for testing. Etched circuits, mounted on translucent plastic for "see-through" serviceability. Complete accessibility of all circuits and tubes. Highest quality components. Ultra-conservative design, with circuits operating well below ratings. Concentric, color-coded controls, grouped by function and simplified. Direct sweep time selection—no mental gymnastics. A new low capacitance clip-on probe (for *-hp-* 150A) has 10 megohm impedance.

Get complete data on the most important oscilloscope improvements in history! Call your -hp- representative now, or write direct!

BRIEF SPECIFICATIONS

-hp- 130A

Sweep Range: 1 μsec/cm to 15 sec/cm.
Calibration: 21 sweeps: 1-2-5-10 sequence, 1 μsec/cm to 5 sec/cm. 5% accuracy.
Triggering: Internal, line voltage or external 2 v or more. Pos. or neg. slope, +30 to —30 v trigger range.
Preset Trigger: Optimum setting for automatic stable triggering.
Input Amplifiers: (Similar Vert. and Horiz. Amps) Sensitivity 1 mv/cm to 50 v/cm; 14 ranges, continuous vernier. Pass band dc to 300 KC.
Amplitude Calibration: 1 KC square wave. 5% accuracy.
Price: $450.00.

-hp- 150A

Sweep Range: 0.02 μsec/cm to 15 sec/cm.
Calibration: 24 sweeps: 1-2-5-10 sequence, 0.1 μsec/cm to 5 sec/cm. 3% accuracy.
Triggering: Internal, line voltage or external 0.5 v or more. Pos. or neg. slope, +30 to —30 v trigger range.
Preset Trigger: Same as *-hp-* 130A.
Horizontal Amplifier: Magnification 5, 10, 50, 100 times. Vernier selects any 10 cm part of sweep. Pass band dc to over 500 KC. Sensitivity 200 mv/cm to 25 v/cm.
Vertical Amplifier: Pass band dc to 10 MC. Optimum transient response and rise time less than 0.035 μsec. Signal delay of 0.25 μsec permits leading edge of triggering signal to be viewed.
Amplitude Calibration: 18 calib. voltages, 2-5-10 sequence, 0.2 mv to 100 v peak-to-peak. Accuracy 3%. Approx. 1 KC square wave, rise and decay approx. 1.0 μsec.
Prices: *-hp-* 150A High Frequency Oscilloscope, $1,000.00.
-hp- 151A High Gain Amplifier, $100.00.
-hp- 152A Dual Channel Amplifier, $200.00.
Data subject to change without notice.
Prices f.o.b. factory.

HEWLETT-PACKARD COMPANY
3696E Page Mill Road • Palo Alto, California, U.S.A.
Cable "HEWPACK" • DAvenport 5-4451
Field engineers in all principal areas

Now, more than ever, *-hp-* means "Complete Coverage"

saturate the radio system receiver, SCAN will not accept erroneous data, but will go on dead reckoning with full memory of the last corrections before interruption."

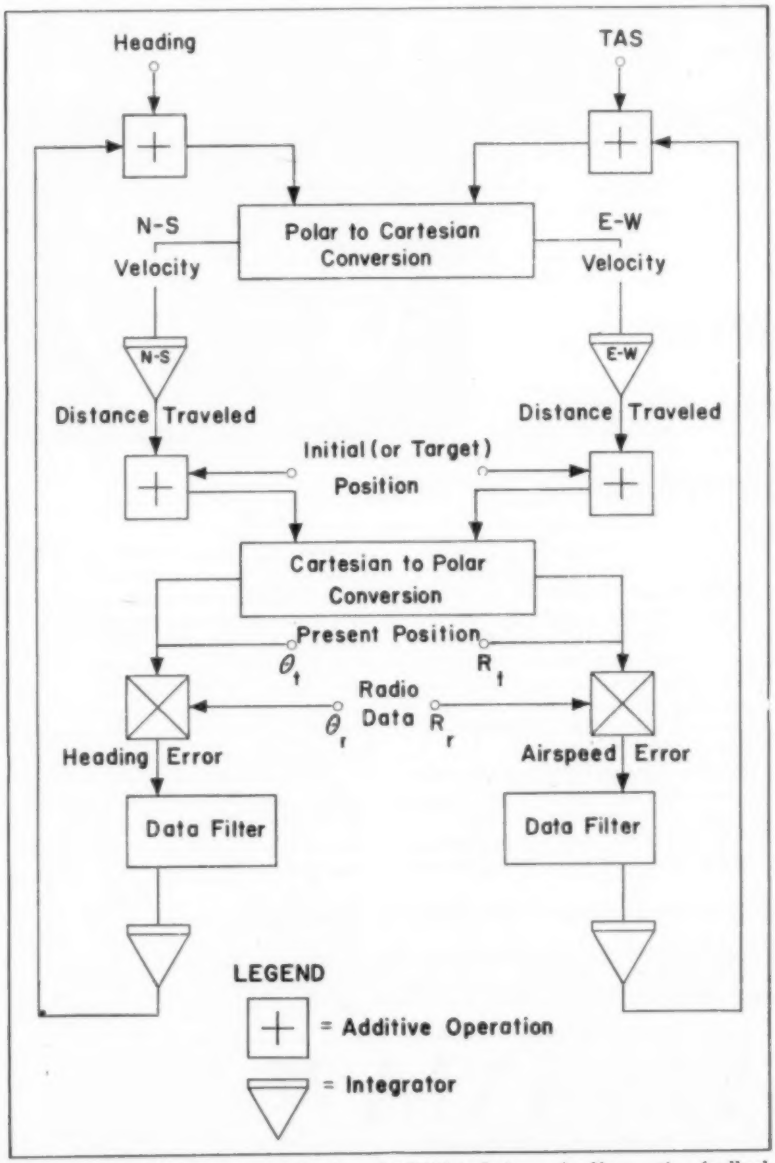
Block Diagram

A more detailed understanding of SCAN's operation can be gained from its block diagram. (See sketch below.) Heading and true airspeed input signals are first converted from polar (rho-theta) to Cartesian (longitude-latitude) coordinates, then integrated as a function of time to give distance traveled in a north-south, east-west direction. The take-off or target coordinates in latitude and longitude are set in manually, and either added to or subtracted from the distance traveled to give present position (relative to take-off point or target).

Present position could be indicated in terms of latitude and longitude, or, as shown in the block diagram, reconverted into polar coordinates to give bearing and distance to the take-off point or destination.

Radio derived data from VOR/DME, or Navarho, indicating aircraft bearing and distance from a known station, is introduced and automatically subtracted from the DR-computed present position. The indicated error is then processed in a data filter to establish its creditability factor.

This weighted error is integrated to establish what correction should be



BLOCK DIAGRAM illustrates application of SCAN technique of self-correcting feedback.

General Electric Offers a Complete Line of Instruments for Both Commercial and Military Aviation

ELECTRICAL QUANTITIES
Voltmeters and Ammeters
Frequency Meters
Watt-Var Meters
Line Test Sets

ENGINE SPEED
Tachometer Generators
Tachometer Indicators

POSITION
Transmitters
Indicators

FUEL FLOW
Transmitters
Indicators
Power Supply

NAVIGATION
Directional Compass Systems
Remote Compass Transmitters
Gyros

LIQUID LEVEL
Transmitters
Indicators

TEMPERATURE
Servo-Indication Systems
Thermocouple Assemblies
Thermocouple Harnesses

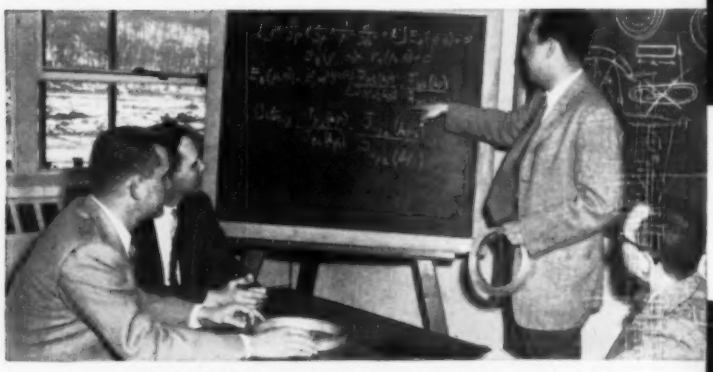
COMPONENTS
Position Elements
Speed Elements
Servo Motors
Temperature Elements
Gyro Motors

TRANSFORMERS FOR AIRCRAFT

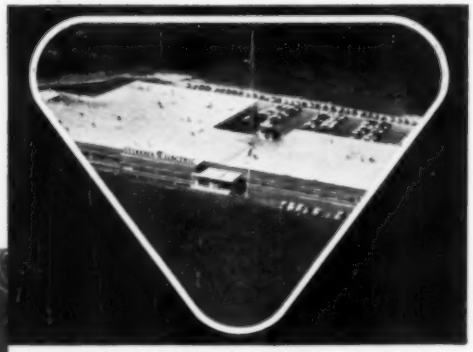
For further information on any of the complete line of General Electric aircraft instruments, contact your nearest G-E Apparatus Sales Office or write Section 586-9, General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

The right people
with the right facilities
produce the right solutions



Sylvania Avionics Laboratory Manager and Department Managers discuss a problem in delay circuiting employing coiled wave guide. Left to right: John Jewett, Laboratory Manager Richard Osgood, Dr. Carl Faflick, and Fred Anderson.



New Sylvania Waltham Laboratories, devoted to advanced projects related to guided missiles and aviation electronics. The air-conditioned building has 120,000 square feet of floor space.

Environmental testing of unique equipment—a radome designed as an integral part of a high-performance airplane wing. Left to right: Dr. Frank Rosato, Frank Lambert, John Ricketts and Joseph Shagoury of the Waltham Laboratories.

Radome

for airplane wing edge

. . . a challenging problem in Avionics

ENGINEERING a radome for the edge of an airplane's wing demands skill and experience in both aerodynamics and electronics. Sylvania's Avionics Laboratory provided these qualities to meet this unique problem in developing an advanced electronic system for a high-performance military aircraft.

Highly advanced electronics projects of many kinds for many environments . . . land and sea, as well as air . . . are constantly being carried out by engineers of the Avionics Laboratory. They have made notable achievements in computers, radar, warning devices, detection devices, jamming equipment, countermeasures, and counter-countermeasures.

In addition to the Avionics Laboratory, Sylvania's Waltham, Mass., facilities include the Missile Systems Laboratory and the Applied Research Laboratory. Each of the three is engaged in pushing back scientific frontiers in electronics—each is a vital part of Sylvania's Electronic Systems Division.

In all of Sylvania's Electronic Systems Division installations, the *right* people work with the *right* facilities, within a sound managerial environment. That is why they have produced *right* solutions to a variety of problems, and have made many important contributions in the fields of aviation electronics, guided missiles, countermeasures, communications, radar, computers, and control systems. Whether the problem is military or industrial, Sylvania's business is to come up with solutions that are *producible*.

The Electronic Systems Division has plant and laboratory facilities at Buffalo, N. Y., and Mountain View, Calif., in addition to its Waltham activities. All are staffed with top-ranking scientists and engineers, backed with Sylvania's extensive resources in the electronics field.

SYLVANIA IS LOOKING FOR ENTERPRISING ENGINEERS

Sylvania has many opportunities in a wide range of defense projects. If you are not now engaged in defense work, you are invited to contact Edward W. Doty, Manager of Personnel, Electronic Systems Division, Sylvania Electric Products Inc., 100 First Avenue, Waltham 54, Mass.

SYLVANIA

SYLVANIA ELECTRIC PRODUCTS INC.

LIGHTING • RADIO • ELECTRONICS • TELEVISION • ATOMIC ENERGY

RADAT System

New narrow-band radar data transmission system, called RADAT, and new manual data inserter, called DATIN, make it possible to superimpose manually drawn notations on aircraft radar blips with superimposed picture being transmitted by telephone line to a remote central control PPI scope. TV-type camera mounted above radar scope (but not visible in above photo) views original radar PPI presentation plus marks placed on scope by operator. System, developed by Skiatron Electronics and Television Corp. for Navy Bureau of Ships, could find civil application in remoting air defense SAGE radar information to Civil Aeronautics Administration traffic control centers.

applied to the heading or airspeed input. (A rate network may be required ahead of each integrator to provide stability because each loop contains two cascaded integrators, Green says.)

The use of double integrator loops not only results in compound filtering of noise or random inputs, but provides a velocity memory for correctly computing through intervals when radio correction data is not available. For example, if there is a steady cross-wind, it will result in an initial discrepancy between DR and VOR-computed position.

This in turn will cause SCAN's output integrator to develop a signal proportional to cross-wind which will feed back to the true airspeed and heading inputs. If the radio signal is lost, the integrator continues to feed in the last-known value of wind velocity and direction until the radio signal returns.

Thus SCAN is able to determine both wind direction and velocity under reasonably steady-state conditions when it has even occasional access to external radio signals. This eliminates the need for the pilot to set in crosswind data as with present DR computers. By the same token, SCAN develops steady-state corrections for steady-state instrumentation errors within the DR computer itself.

SCAN's data filter, the key to its novel characteristics, makes use of statistical probability theory techniques to assign creditability weighting factors. Lear says that it has demonstrated these techniques on a laboratory basis, but cannot disclose details at this time, presumably for patent and competitive reasons.

However, the firm says that the entire filtering-creditability weighting function can be performed by three tubes, or their transistor equivalent.

Although the foregoing discussion has described pure DR computers with airspeed and heading inputs to illustrate SCAN principles, the system is equally adaptable to lightweight inertial guidance systems, and can employ a variety of radio aids for external reference, including two automatic direction finders, Loran, Decca, or ground-radar measured position data relayed to the aircraft by data link.

Expansions, Changes In Avionics Industry

Sylvania Electric Products, Inc. has announced the formation of a Microwave Physics Laboratory near the firm's Microwave Tube Laboratory and Electronic Defense Laboratory at Mountain View, Calif. New laboratory will conduct research and advanced develop-

marion
advancement in instrument design

GYRO-LIKE
STABILITY
IN AIRCRAFT INSTRUMENT MECHANISMS
(moving coil)

Accurate instrument indication – under typical flight conditions of rapid attitude changes, acceleration and vibration – requires mechanism performance far exceeding that of conventional panel meters. Marion approached the problem by disregarding previous design concepts, and using new materials in a completely new configuration. Resultant MEP-1 mechanism provides stability and reliability previously unknown to aircraft application.

MEP-1 Mechanism

marion meters
MEDALIST
marion electrical instrument company
GRENIER FIELD—Manchester, N. H., U.S.A.
Copyright ©1956 marion

New
FIXED PITCH METAL
CAA approved up to 165 hp.
FIXED PITCH WOOD
CAA approved up to 225 hp.
TEST CLUBS
up to 3000 hp.

Get all the facts...
write for Bulletins and Price Lists.

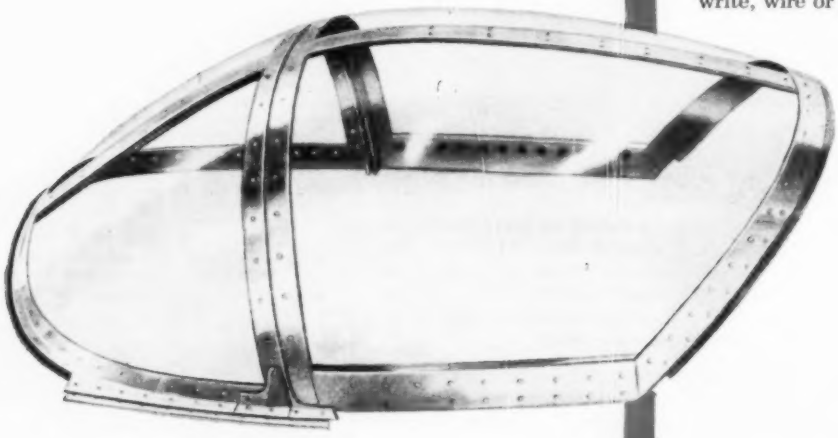
Dept. W, Sensenich Corp., Lancaster, Pa.

Sensenich PROP SHOP... Certified Repair Station for all makes fixed pitch metal or wood propellers ... Sensenich, Beech and Hartzel, controllables. Magnaflux, etching, anodizing and plating service available. Service Hangar on Lancaster Municipal Airport. Approved Propeller Repair Station 3528. Unlimited Class 1 and 2 ratings.

AIRCRAFT PROPELLERS
SENSENICH
Serving the Aircraft Industry
for a Quarter of a Century

Contributing precision-made cockpit enclosures to America's air arm

The Cessna T-37 will help to train tomorrow's jet pilots faster and at less cost. An enlarged cockpit enclosure made by Kawneer gives the instructor and trainee improved visibility. With our knowledge of acrylics and specialized facilities in our new, modern plant we are prepared to take the complete responsibility for your cockpit enclosure program. Our forming, routing, edging, optical testing and glazing to metal facilities are available to produce any part of your cockpit enclosure—from the acrylics only to the complete assembly—write, wire or phone.



- Cockpit Enclosures
- Major Airframe Assemblies
- Acrylic Forming and Fabrication
- Jet Engine Sheet Metal Parts and Assemblies
- Miscellaneous Sheet Metal and Extruded Parts
- Heliarc Welding

50TH ANNIVERSARY

Kawneer AIRCRAFT PRODUCTS DIVISION

General Offices NILES, MICHIGAN

1906–1956

Write for new Kawneer Aircraft Products books for complete description of facilities.

Engineers: Kawneer offers excellent opportunities for growth and advancement. Bring your family to Niles and enjoy vacationland living. Work in new, modern facilities.

ment in new magnetic materials and gaseous media for microwave communications, radar, and countermeasures. Osmund T. Fundingsland will head new laboratory. Sylvania will also expand its present Microwave Tube Laboratory facility by adding 18,000 sq. ft. to the present 40,000 sq. ft. Occupancy is planned for fall.

Other recent expansions and changes in the avionics industry:

• **Amphenol Electronics Corp.** is new name of the American Phenolic Corp., Chicago, a name which better reflects the firm's current activities.

• **Magnetic Amplifiers, Inc.,** New York, has opened a West Coast Division at 136 Washington St., El Segundo, Calif.

• **Texas Instruments, Inc.,** Dallas, has consolidated its Semiconductor Products and Components divisions into a single division, headed by Mark Shepherd, Jr. Company will increase size of new division plant slated for construction this year from original 150,000 sq. ft. to 200,000 sq. ft. Firm reports its semiconductor sales are up 400% over last year.

• **Loral Electronics Corp.,** New York, has broken ground for its new 100,000-sq.-ft. plant in a new industrial area at Bronx River Avenue.

• **ACF Electronics divisions** instrumentation activities have been merged into the company's Avion Division, but remains at the same address: 800 North Pitt and 524 North Pitt, Alexandria, Va. Company's "Project Tinkertoy" activities, located at 1321 Leslie Ave., Alexandria, will continue as ACF Electronics division.

• **General Electric's Rectifier Department** will construct a new 250,000-sq.-ft. plant, including office and laboratory space, just outside Lynchburg, Va. Completion is slated for early 1957.

FILTER CENTER

▶ **Redstone Guidance**—Inertial guidance for Army's Redstone missile is being produced by Ford Instrument Co., division of Sperry-Rand. Firm also is developing inertial guidance for more advanced Army ballistic missiles.

▶ **IRE Membership Jumps**—Institute of Radio Engineers had 49,000 members at last count, a 14% increase over the previous year, Arthur V. Loughren, IRE president, reports.

▶ **Fertile Field**—Airborne digital computer design would be greatly simplified if someone could devise an analog-to-digital shaft-position converter which gives sine or cosine of the shaft position in digital form. At present, computer must generate its own sine, cosine functions for fire control, navigation and

Another example of Farnsworth's pioneering achievements in the field of infrared.

Originally developed for the military this compact, light weight Viewer is proving equally useful in industry and science, wherever there is a need to see in the dark.

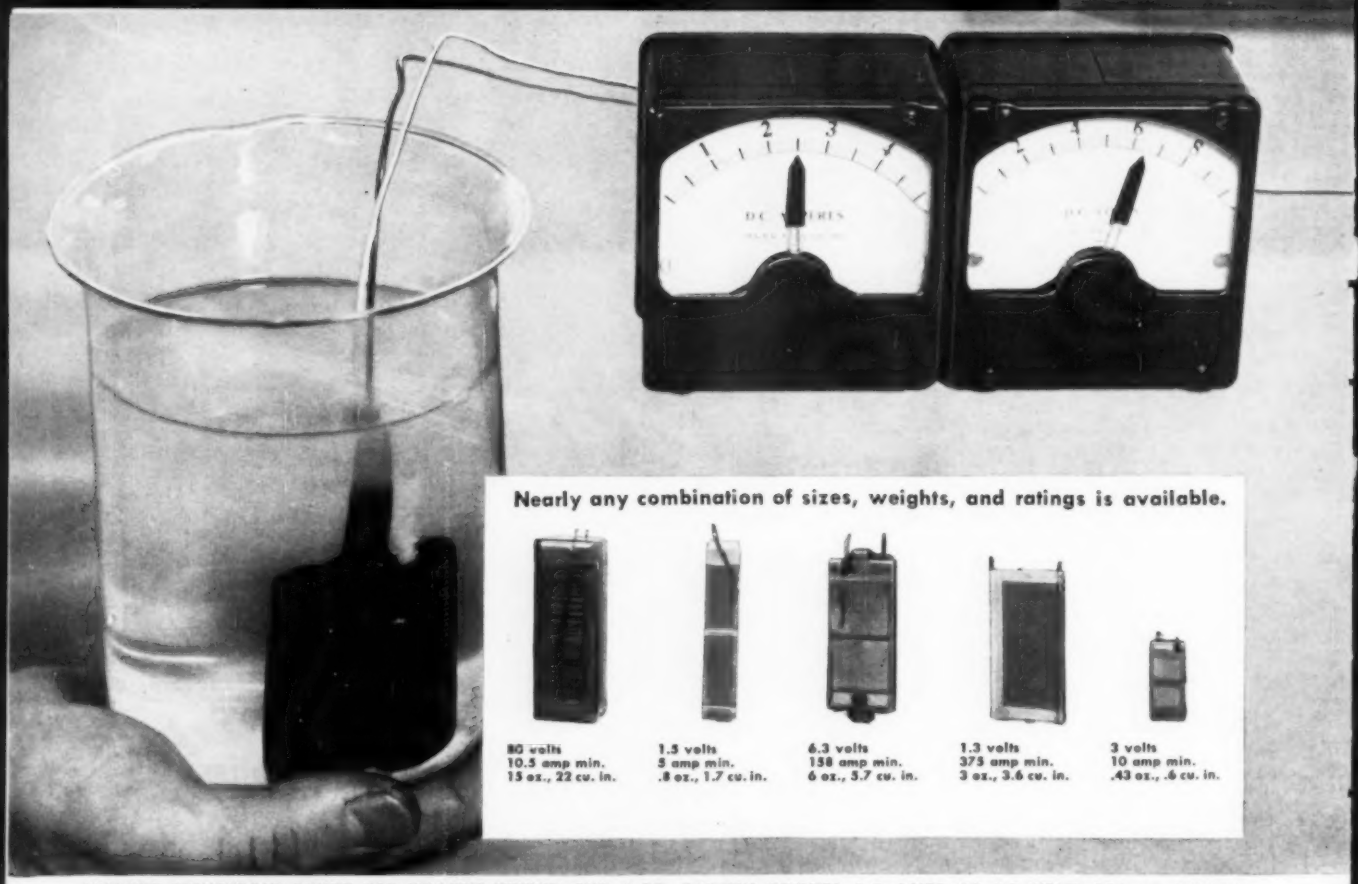
For complete details on the Infrared Viewer write Dept. V-56.

Farnsworth

A DIVISION OF IT&T

FARNSWORTH ELECTRONICS CO. • FORT WAYNE, INDIANA

a division of International Telephone and Telegraph Corporation



SHOWING TREMENDOUS POWER FOR RELATIVE WEIGHT, THIS 3-OZ. BATTERY DELIVERS 2.5 AMPS AT 6.3 VOLTS FOR 16 MINUTES.

WHERE CAN YOU USE . . .

G.E.'s New Water-activated Batteries with High Power-to-weight Ratio

G.E.'s new water-activated batteries are designed to give maximum power for the least possible weight and volume per unit. In many applications, these silver-chloride/magnesium batteries will furnish up to TWICE the output of silver-oxide/zinc batteries and up to FOUR TIMES that of lead-acid batteries of corresponding size and weight.

FOR USE NEARLY ANYWHERE, G-E water-activated batteries are activated by immersion in water. In land or air-borne applications, activation is accomplished by other saturation methods. This versatility makes them an ideal power source for many specialized applications.

THE COMPLETELY DRY CONSTRUCTION of G-E water-activated batteries simplifies many storage problems. Since they contain no water during storage, danger of freezing and power loss is eliminated. With normal precaution against moisture, length of storage will not alter their come-up time—They still reach operating voltage within two seconds after activation!

THE WIDE VARIETY OF DESIGNS possible with G-E water-activated batteries, ideally suits them to the power requirements and space limitations of certain equipment now using bulky, heavier power supplies. If your power needs can be satisfied with a water-activated battery, investigate G.E.'s line today. And remember, though a wide range of ratings and sizes is available, G-E water-activated batteries can be designed to your specific needs. For detailed information, contact your G-E Apparatus Sales Office, or send coupon below for free descriptive bulletin.

Progress Is Our Most Important Product

GENERAL ELECTRIC

General Electric Co., Section A223-3
Schenectady 5, N. Y.

Please send me Bulletin GEA-6238A on Water-activated Batteries

I am requesting this information

- ☐ For immediate project
- ☐ For reference only

Name.....

Position.....

Company.....

City.....Zone.....State.....

bombing use, taking up valuable machine time and capacity. Baldwin Piano Co., reportedly is working on such a converter.

▶**New Recruiting Technique**—Monroe Calculating Machine Co. is trying a different tack in recruiting engineers. Recent issue of the N. Y. Times carried the following Monroe ad:

"WIVES OF ENGINEERS, live in beautiful Morris County, N. J. Is your husband an electronic engineer, age 25-35? Coax him to call."

▶**Librascope First?**—An airborne digital bombing computer developed by Librascope under Navy Bureau of Ordnance sponsorship reportedly is the first digital computer to be tested under actual bomb-drop conditions. Firm is now developing new airborne digital computer, capable of handling bombing, navigation, and cruise-control tasks, which is estimated to weigh only 20 lb.

▶**Tradic To Undergo Tests**—All-transistor digital computer (Tradic) being developed by Bell Telephone Laboratories under Wright Air Development Center sponsorship will be tested as part of the K-5 bombing-navigation system in a B-66.

▶**"White Alice" Contract Let**—Federal Electric Corp., subsidiary of International Telephone & Telegraph Corp. has received USAF contract for operation and maintenance of the Alaskan Integrated Communications Exchange network ("White Alice"). The network, when complete, will consist of trans-horizon and microwave links to interconnect isolated cities and defense installations in Alaska.

▶**New UHF Direction Finder**—The Rome Air Development Center has awarded a $100,000 contract to Servo Corp. of America for R & D on a ground-based UHF Doppler-type radio direction finder. Company expects to employ a medium-aperture antenna system to reduce adverse terrain effects which existed in previous UHF direction finders. The system is to have an azimuth bearing accuracy of one degree or better, range of at least 120 miles, and be capable of remote site operation.

▶**Transistors Stabilize F-104A**—Lear's stability augmentation system for the Lockheed F-104A is the first three-axis system ever applied to a production airplane and is believed to be the first transistorized flight control system put into production for supersonic aircraft, Lear President Richard Mock told recent stockholders meeting. Mock reported company backlog of $58 million, highest since December, 1953.

Royal
AMPHIBIAN NEWS

Notes on America's outstanding utility amphibian for business flying and charter service operation

ROYAL AIRCRAFT NAMES DISTRIBUTOR FOR FIVE GULF STATES

Gulf Aircraft Sales, Inc., with offices at 818 Pioneer American Bldg., Houston, Texas, was selected to represent Royal Aircraft in five Gulf states, according to Royal's general manager, Max I. Black. Gulf's territory includes Texas, Oklahoma, Arkansas, Louisiana and Mississippi.

Modern sales and service facilities have been established at Gault Aviation, Cudahy Field, Corpus Christi, Texas. Future plans include another base of operations in New Orleans.

Officers of Gulf Aircraft are T. E. Mosheim, president; Fred L. Prue, vice president; Sol Jamail, manager of operations and John E. Koch, business manager.

If you'd like to know how the Royal Gull fits into your air-transport picture, write direct—

Royal
AIRCRAFT CORPORATION
6781 West National Avenue
MILWAUKEE 14, WISCONSIN
A subsidiary of Kearney & Trecker Corp.

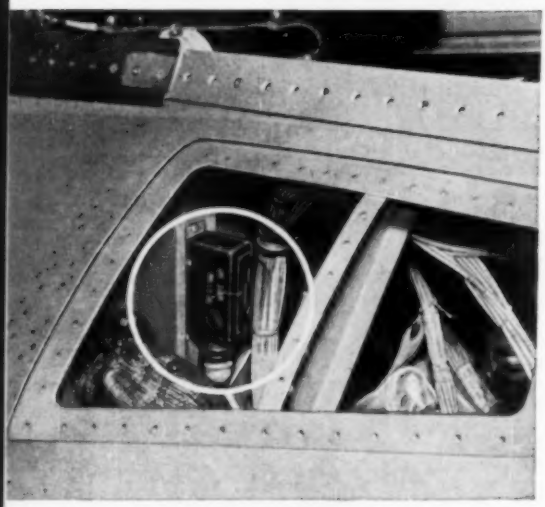
AIRCRAFT TUBING

GOVERNMENT SPECIFICATION TUBING IN STOCK..

- A.I.S.I. 4130.....MIL-T-6736
- A.I.S.I. 4130.....AN-T-69
- A.I.S.I. X-4130.....AN-WW-T-850A
- A.I.S.I. 1025.....AN-WW-T-846

SERVICE STEEL • DETROIT, MICHIGAN LOS ANGELES, CALIFORNIA

IN THE CONVAIR F-102A, the Fenwal Thermistor Over-Heat Detector, 81000 Control, warns the pilot if the windshield becomes overheated. The windshield in the Convair F-102A is heated with hot air. At extremely low temperatures this serves to raise the temperature of the windshield and prevent fogging. If the air continues to heat the windshield after coming from the low temperature area, the Fenwal thermistor unit prevents the danger of the glass cracking by warning the pilot to turn off the heat.



THE THERMISTOR OF THE FENWAL 81000 is located in the tip of a spring loaded probe which conveniently screws into one of the positions normally occupied by one of the screws which hold the windshield in place. The spring loaded probe extends into the inner glass surface and laminated portions which form the center of the laminated "sandwich."

HOW FENWAL'S THERMISTOR OVER-HEAT DETECTOR PROTECTS CONVAIR'S F-102A

The Fenwal Thermistor Over-Heat Detector gives quick, dependable response to temperature changes in a variety of aircraft applications. Its compact size and light weight, plus conformance to applicable military specifications, may be the answer to one of your temperature control problems.

Write for complete data to **Fenwal Incorporated, Aviation Products Division, 126 Pleasant Street, Ashland, Mass.**

Fenwal Controls Temperature ...*Precisely*

THE FENWAL 81000 CONTROL UNIT consists of a black crackle finished aluminum housing with a five pin male receptacle for connecting the power supply, a thermistor probe, and an indicating device. The unit features an adjustable potentiometer that is accessible through the top and has a hermetically sealed relay with all components coated with a fungicide varnish.

It has an input of 20-30 volts D.C. at .05 amperes maximum. Load contacts are rated at 30V. D.C. at 2 amperes maximum; non-inductive. The adjustable range of the unit is 170°F ±10°F, to 270°F ±10°F. It has a temperature differential of 10°F maximum over adjustment range, maximum storage temperature of 212°F and operating temperature range of −65°F to 160°F. Total weight of probe and control unit is less than 0.5 lb.

NEW AVIONIC PRODUCTS

Components & Devices

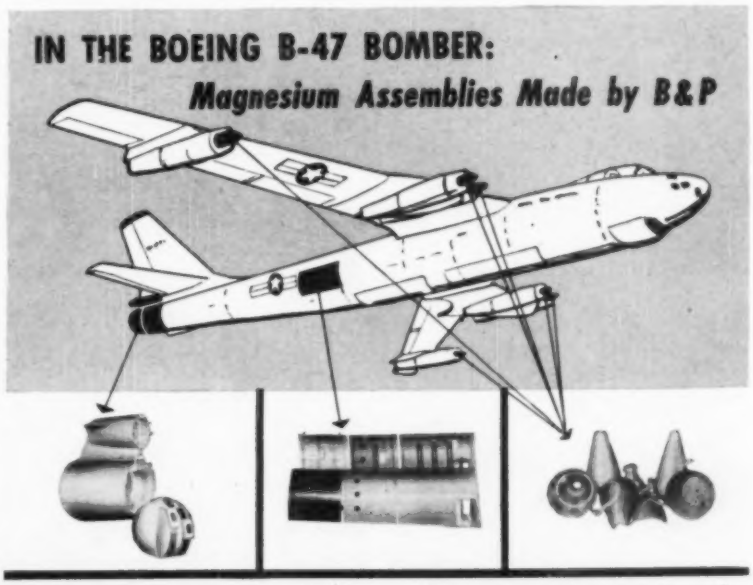
• **Sub-miniature relay,** featuring positive adjustment of contact and plunger travel, comes in two-pole, hermetically sealed model. Contacts are rated two amps resistive at 28 v.d.c. or 115 v.a.c. Relay can operate at temperatures up

to 125C, and withstand 50G shock. Coil resistance is 480 ohms for 28 v.d.c. operation, and relay operates on 350 mw. Unit weighs 1 ounce, measures 0.65 in. diameter x 1.8 in. long. General Electric Co., Specialty Control Dept., Waynesboro, Va.

• **Tach-servo motor combination,** size 15, for 400 cps use, features low tach null voltage, 0.008 v.a.c. maximum fundamental. Output voltage is 3.2 v.a.c./1,000 rpm. Servo motor has no-load speed of 4,500 rpm., stall torque of 1.45 in. oz. Fixed phase input is 115 v.a.c., variable phase is available with 57.5, 115, or 230 v.a.c. Basler Electronics Inc., Highland, Ill.

• **Miniature 16 KV power supply,** transistorized d.c. to d.c. converter can produce 16,000 volts from as little as 3-volt input. Unit weighs 1½ lb., measures only 1½ x 3 x 6 in. Standard temperature range is −25C to 75C, but this can be extended to −55C to 100C. Units are available on special order

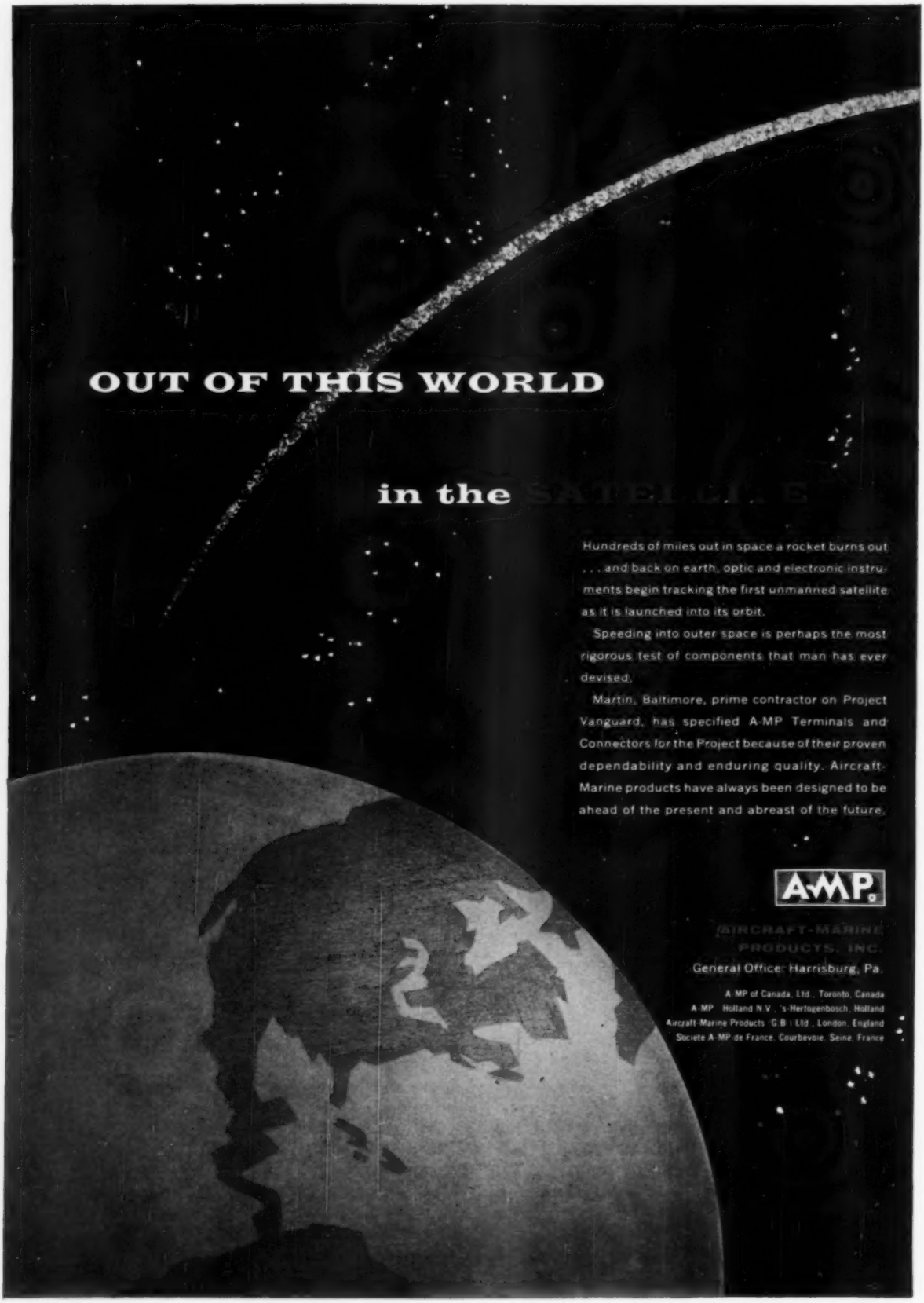
Aircraft seats?
– then you ought
to know ELLIS CLARK!
He's the "conscience" behind TECO Purchasing – especially where your best interests are concerned. As an able sales engineering representative, Ellis is widely known in aviation circles for his sound advice and know-how on airline seats.
Ellis knows airline seats because he's with 'em every day, full time! As with TECO, it's his livelihood, receiving his full attention – helping to produce the best airline seats you can buy! No matter under which job hat you know Ellis – take it from us and our satisfied customers, you've got the right man – from TECO!
TECO INC.
3210 WINONA AVENUE • BURBANK, CALIFORNIA



Tail cone and gun turret enclosure are supplied by B&P to General Electric Co.; smooth panel doors made for Lockheed and Douglas B-47 production; and the inboard and outboard jet pods for Bell Aircraft Co. In addition, B&P produces magnesium cases and components for electronics systems in the B-47 and many other military planes.

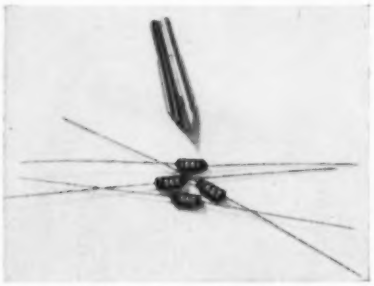
Write for folder describing B&P's facilities for magnesium and titanium work.

BROOKS & PERKINS, INC. 1932 W. Fort St. Detroit 16, Mich.
Offices in New York, Washington, Los Angeles and Dallas


OUT OF THIS WORLD
in the SATELLITE
Hundreds of miles out in space a rocket burns out . . . and back on earth, optic and electronic instruments begin tracking the first unmanned satellite as it is launched into its orbit.
Speeding into outer space is perhaps the most rigorous test of components that man has ever devised.
Martin, Baltimore, prime contractor on Project Vanguard, has specified A-MP Terminals and Connectors for the Project because of their proven dependability and enduring quality. Aircraft-Marine products have always been designed to be ahead of the present and abreast of the future.
A-MP
AIRCRAFT-MARINE PRODUCTS, INC.
General Office: Harrisburg, Pa.
A-MP of Canada, Ltd., Toronto, Canada
A-MP Holland N.V., 's-Hertogenbosch, Holland
Aircraft-Marine Products (G.B.) Ltd., London, England
Societe A-MP de France, Courbevoie, Seine, France

for other requirements. Universal Atomics Corp., 19 East 48th St., New York 17, N. Y.

• **Sub-miniature silicon diodes,** high-conductance junction type, are available in four new models, 660, 661, 662, and 663, all rated for operation at ambient temperatures up to 150C. Individual models provide peak reverse voltage

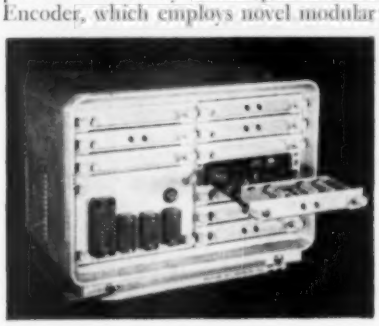


ratings of 30 to 200 volts, with 100 ma. forward current rating at 25C, which is independent of breakdown voltage. Reverse currents are only 1 microamp. Diodes are glass encapsulated. Bulletin DL-S 614 gives complete application data. Texas Instruments, Inc., 6000 Lemmon Ave., Dallas 9, Tex.

• **High temperature capacitors,** employing Teflon dielectric, for operation at temperatures of −70C to 200C, are available in two types of enclosures, either hermetically sealed brass cartridge or glass encapsulated. Units reportedly meet or exceed MIL-C-25, have temperature coefficient of −200 ppm/Deg.C over full temperature range. Insulation resistance ranges from 500,000 megohms x mfd. at −70C to 1,000 meg x mfd. at 200C. Standard voltage ranges of 200 to 1,000 v.d.c. are available, with capacitance range of 0.001 mfd to 1.0 mfd. Condenser Products Co., 140 Hamilton St., New Haven, Conn.

Instrumentation

• **Digital encoder,** Model R-1047-40-1, an all-electronic type converter for airborne or ground use, accepts 0-10 v. inputs and generates 24,000 8-bit binary code groups per second which define input to an accuracy of one part in 256. Encoder, which employs novel modular



Provide a Jet Jockey with accurate navigation and plenty of gas and he's not much worried which way he goes. But direction means a lot in the power plant that gets him there. For example, reverse flow in any part of a compressor bleed system can play hob with engines, instruments, or equipment.

To assure an efficient reverse flow check that withstands excessive temperatures, pressures and ambient conditions, Century engineers have developed the Type 12000 Hot Air Check Valve. Designed for stainless steel ducting application, the unit operates at pressures from 0 to 300 psig and temperatures ranging from −100 to 1,000°F. Ambient range is −100 to 700°F. The valve may be installed in any position and is built with the entire working section as a single assembly, allowing its removal for service without disturbing ducts.

Answering one of jet aviation's many control problems, the Hot Air Check Valve provides a practical solution through Pneumatics . . . the dependable stock-in-trade of Century Controls Corp.

Other Products: Absolute & Gage Pressure Regulators, Vent Pressure Relief Valves, Air Flow Controls, Shut-off Valves.

Send for data sheet on this and other Pneumatic Pressure Regulating Equipment.

Control problems welcomed . . . solutions, based upon Pneumatics, promptly submitted.

Century Controls CORPORATION

Allen Boulevard • Farmingdale • New York • CHapel 9-5900

Guided Missile Research *at* The Ramo-Wooldridge Corporation

Ramo-Wooldridge's primary systems engineering responsibility for the Air Force Intercontinental Ballistic Missiles and the Intermediate Range Ballistic Missile involves a wide variety of complex interrelated technical and operational problems.

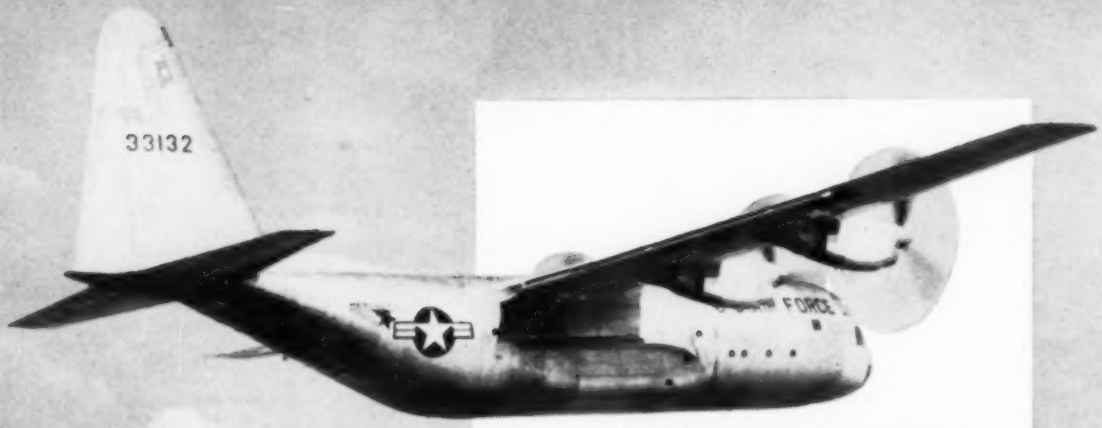
Successful execution of these systems engineering programs requires a staff whose membership includes experts in a wide variety of scientific and engineering specialties. Among the many areas of senior responsibility on the Technical Staff are these...

Aerodynamics
Heat Transfer
Fluid Mechanics
Electro-Mechanical Controls
Meteorology
Instrumentation
Antenna Design
Structural Analysis
Applied Mathematics
Aero Mechanics

Scientists and engineers interested in participating in these systems research programs are invited to consider the opportunities at Ramo-Wooldridge. Inquiries and resumes should be addressed to: Mr. Donald L. Pyke

The Ramo-Wooldridge Corporation
5730 Arbor Vitae St. • Los Angeles 45, California

HERCULEAN TASK:



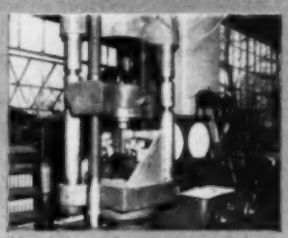
isolating vibration from 15,000 horses

Engine vibrations on the new Lockheed C-130A Hercules turboprop transport are effectively controlled by a LORD-designed Dynafocal® Engine Suspension. As a result, this multi-purpose Air Force combat plane produces greater comfort, safer operation with less structural wear.

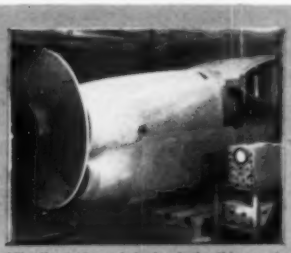
Each of the four Allison T-56 turboprop engines is suspended on a special LORD Dynafocal three-point mounting system. Bonded rubber mountings efficiently isolate vibrations developed by the 3,750 hp powerplants that weigh 2,778 pounds and have a thrust of 8,000 pounds.

Most of our modern aircraft rely on LORD mountings for increased passenger comfort and safety. These mountings are the product of LORD's research and engineering services which are available for the solution of your vibration problem. Call your nearest LORD Field Engineer or write the LORD Manufacturing Co., Erie, Pennsylvania.

HOW LORD ENGINEERS TACKLED THIS PROBLEM



After design of 3-point suspension system, mountings were subjected to destruction tests on this equipment to determine yield and failure points. Rear mounting illustrated.



Vibration tests made in developing this mounting were performed with an actual Lockheed C-130A nacelle structure.

Front mounting installation shows restricted envelope limitations. C-130A develops 15,000 hp, uses 12 Lord mountings to control engine motion under all load conditions.

NEW YORK, N. Y. - Circle 7-3326 • PHILADELPHIA, PA. - LOcust 4-0147
CLEVELAND, OHIO - SUperior 1-3242 • DAYTON, OHIO - Michigan 8871
DETROIT, MICH. - TRinity 4-2060 • CHICAGO, ILL. - Michigan 2-6010
DALLAS, TEXAS - Riverside 3392 • LOS ANGELES, CAL. - HOllywood 4-7593
"In Canada—Railway & Power Engineering Corporation Limited"

LORD MANUFACTURING COMPANY • ERIE, PA.

LORD
BONDED RUBBER

designers and producers of bonded rubber products since 1924

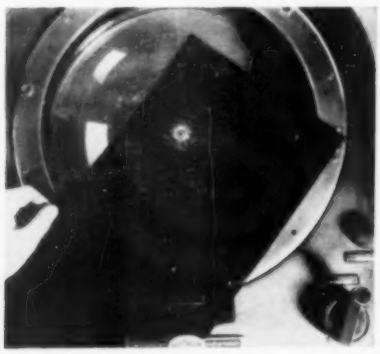
tray assemblies, weighs only 8 lb., measures approximately 7 x 9½ x 6¾ in. Radiation, Inc., Melbourne, Florida.

• **Airborne tape transport,** for magnetic recording, comes in two new models. Model 541 has capacity for 10½-in. tape reels, Model 581 handles 7¼ in. reels. Units aare available either with a d.c. or 400 cps capstan motor, with tape speeds

of ½ to 30 in./sec. Transports may be operated at temperatures of −55C to 55C. Engineering Bulletins 3110 and 3111 give application data. Davies Laboratories, Inc., 4705 Queensbury Road, Riverdale, Md.

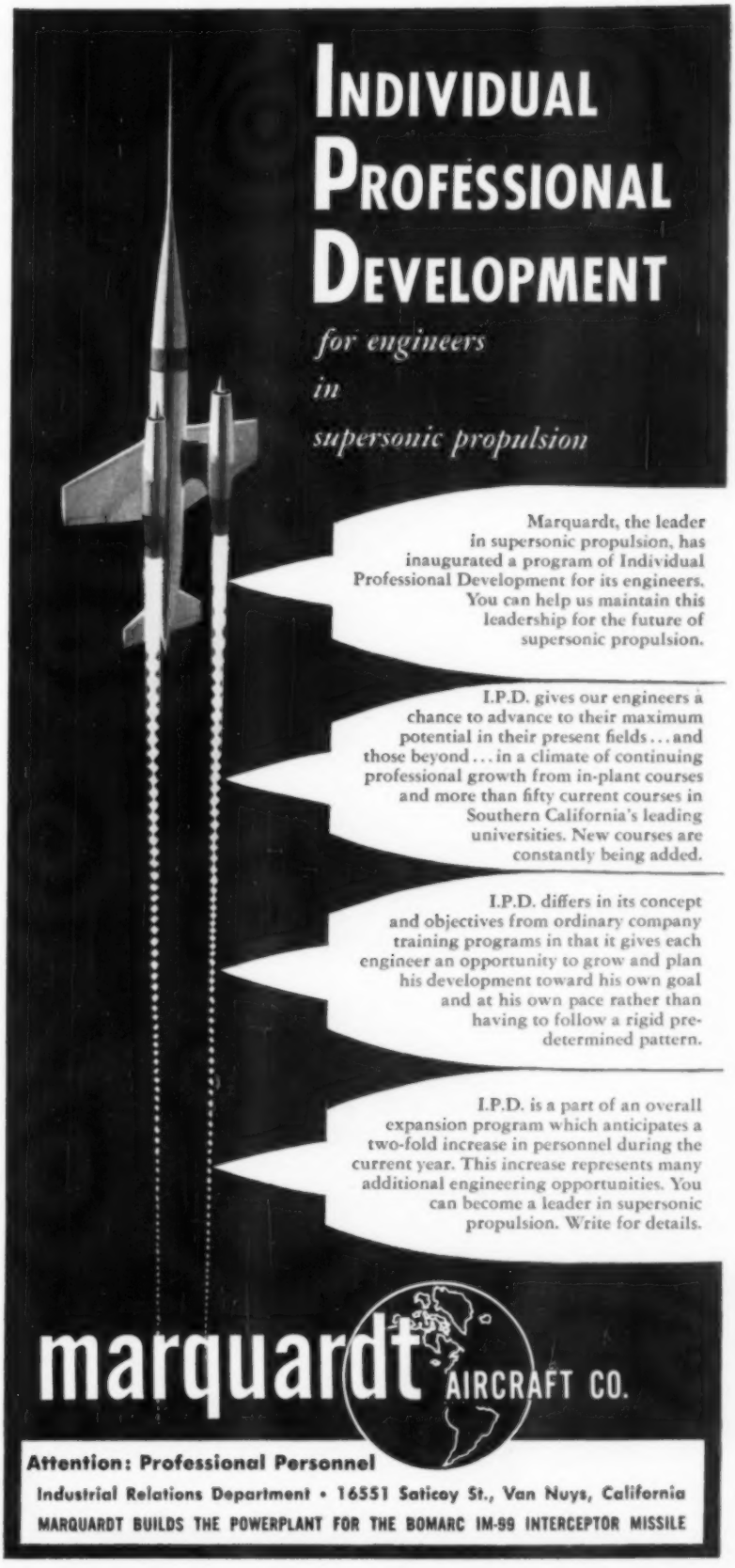
Microwave Devices

• **Radar scope filters,** reportedly trap between 98-99% of all reflected light impinging upon a radar scope. Filter can be laminated in either glass or plastic for easy mounting on any size

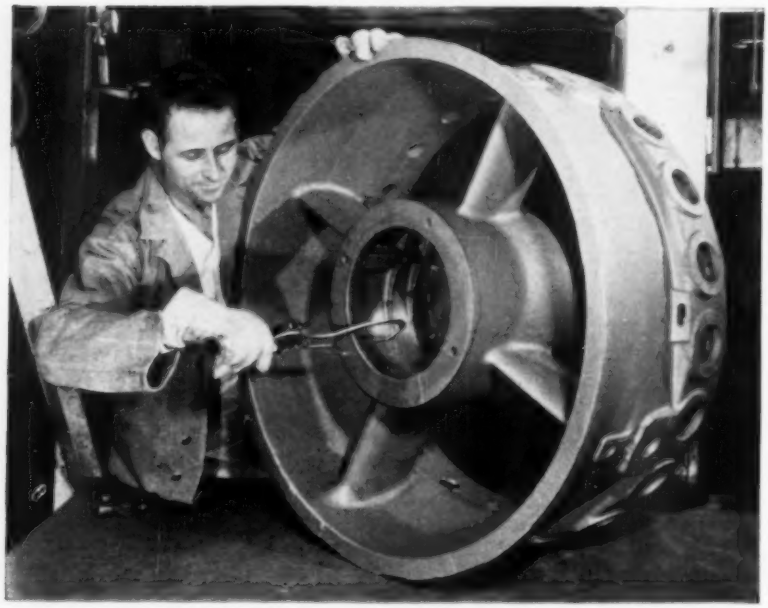


scope, or can be combined with a linear-polarized filter so observer can vary display brightness by pushing a knob without readjusting scope itself. Polaroid Corp., 730 Main St., Cambridge, Mass.

• **Traveling wave tube pulsed amplifier,** Types HA-12 and HA-13, for operation in the S and X-bands respectively. Both have 1 watt output. Positive grid control is provided for amplitude modulation and automatic gain control. Huggins Laboratories, Inc., 711 Hamilton Ave., Menlo Park, Calif.


INDIVIDUAL
PROFESSIONAL
DEVELOPMENT
for engineers
in
supersonic propulsion
Marquardt, the leader in supersonic propulsion, has inaugurated a program of Individual Professional Development for its engineers. You can help us maintain this leadership for the future of supersonic propulsion.
I.P.D. gives our engineers a chance to advance to their maximum potential in their present fields... and those beyond... in a climate of continuing professional growth from in-plant courses and more than fifty current courses in Southern California's leading universities. New courses are constantly being added.
I.P.D. differs in its concept and objectives from ordinary company training programs in that it gives each engineer an opportunity to grow and plan his development toward his own goal and at his own pace rather than having to follow a rigid predetermined pattern.
I.P.D. is a part of an overall expansion program which anticipates a two-fold increase in personnel during the current year. This increase represents many additional engineering opportunities. You can become a leader in supersonic propulsion. Write for details.
marquardt AIRCRAFT CO.
Attention: Professional Personnel
Industrial Relations Department • 16551 Saticoy St., Van Nuys, California
MARQUARDT BUILDS THE POWERPLANT FOR THE BOMARC IM-99 INTERCEPTOR MISSILE

QUALITY MAGNESIUM CASTINGS



A MAGNESIUM SAND CASTING at the Dow foundry. Many kinds of castings are produced—with quality standards to meet the special needs of the aircraft industry.

. . . *for the Aircraft Industry!*

ORDINARY AND EXTRAORDINARY SAND CASTINGS

PERMANENT MOLD CASTINGS

PLASTER CASTINGS

YOU NAME THE CASTING, Dow can supply you with any shape or size required. Specialized inspection techniques rigidly maintain your standards and specifications. Heavy-wall or thin-wall, the best—and surest—answer to your problems are Dow magnesium castings! Contact your nearest Dow sales office for additional information.

THE DOW CHEMICAL COMPANY
Foundry Sales, Bay City, Michigan

DOW

WHO'S WHERE

(*Continued from page 23*)

Hugh E. Webber, chief engineer, Microwave Electronics Division, Sperry Gyroscope Co., Great Neck, N. Y.

William Cunn ingham, supervisor-sales to commercial jet airlines, Greer Hydraulics, Inc.

Jacques H. Mercier, products manager, Greer Industries, Inc., affiliate of Greer Hydraulics, Inc., New York International Airport, Jamaica, N. Y.

Robert B. Roe, facility planning manager, Aviation Division (Phoenix, Ariz.), Sperry Rand Corp., N. Y.

William F. Whitesides, engineering manager, and **C. Harry Smith,** chief engineer, Flight Refueling, Inc., Baltimore, Md.

Don Marshall, general sales manager, Frye Corp., Ft. Worth, Tex.

John L. Cramer, manager-plastic balloon operations, General Mills, Inc., Minneapolis, Minn.

Lester K. Fero, preliminary design assistant chief, Bell Aircraft Corp., Buffalo, N. Y. Also: **Arthur Schnitt,** chief-structures, and **Robert Goldin,** assistant chief-structures.

W. A. (Dick) Pulver, assistant chief engineer, Lockheed Aircraft Corp., Marietta, Ga. Also: **Lee Eminger,** military sales planner.

Arthur E. Franks, operations manager, Vacuum Metals Corp., Pittsburgh, Pa. Also: **Christopher S. Houghton,** superintendent-melting.

Albert E. Morjig, director-maintenance, and **Michael J. Lewis,** superintendent-maintenance, Transocean Air Lines.

Ingram Lee, II, production manager, Texas Instruments, Inc., Dallas, Tex. Also: **W. R. Bailey** and **Ronald F. Keener,** assistant chief engineers, Apparatus Division Engineering Dept.

James E. Fitzsimmons, representative-defense projects development, Atlantic Research Corp., Alexandria, Va.

Edwin Zak, manager-aircraft engineering, Trans World Airlines. He will be based at Boeing Airplane Co., Seattle, as TWA representative.

O. Paul Staderman, marketing director, Computer Division, Bendix Aviation Corp., Los Angeles, Calif.

Dr. Clarence H. Beck, design specialist, Flight Test Electronics Dept., Missile Systems Division, Lockheed Aircraft Corp., Van Nuys, Calif. Also: **Dr. Albert D. Wasel,** research scientist, Systems Analysis and Evaluation Dept.

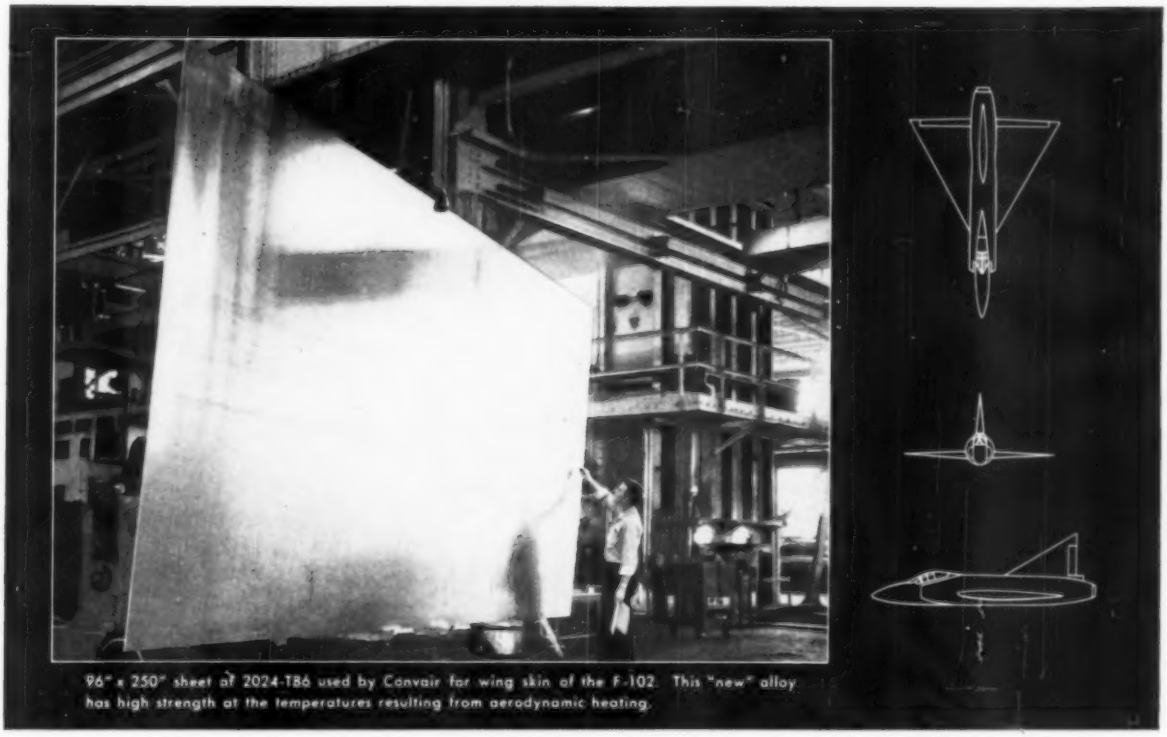
Mark R. Miller, domestic sales manager-commercial aircraft (California Division), and supervisor-New York sales office, Lockheed Aircraft Corp., Burbank, Calif. Also: **Henry C. Bosserman,** chief pilot, Fighter and Trainer Dept. (Palmdale); **J. Russell Daniell,** chief project engineer-military aircraft, and **Arthur E. Flock,** chief project engineer-commercial aircraft.

Edmund A. Schreiber, purchasing manager, Century Engineers, Inc., Burbank, Calif.

A. E. Hill, works manager, Convair, San Diego, Calif. Also: **R. W. Peters,** chief tool engineer.

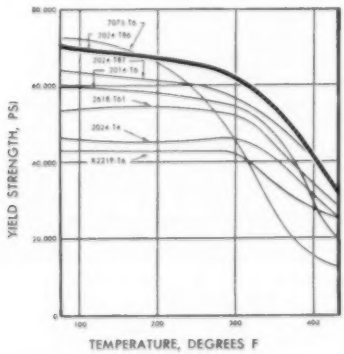
William F. Johnson, sales director, Consolidated Electrodynamics Corp., Pasadena, Calif.

"Newest" Alcoa® high-temperature alloy was born 30 years too soon



96" x 250" sheet of 2024-T86 used by Convair for wing skin of the F-102. This "new" alloy has high strength at the temperatures resulting from aerodynamic heating.

One of the "newest" aluminum alloys finding a place in aircraft today is 2024 with –T86 temper. 2024–T86 has excellent room temperature properties, and in the 200 to 400° range it is superior to *any* currently available alloy. See chart below. Aerodynamic heating at today's higher speeds can make 2024–T86 one of our most important "new" alloys.



Yield strength of wrought alloys at elevated temperature after 100 hours at temperature.

Actually, only the popularity of 2024–T86 is new. Alloy 2024 was developed by Alcoa in the 1920s and the artificial aging process (required for the –T86 temper) was understood in the 1930s. However, for optimum corrosion resistance, 2024 must be aged to a point which reduces its elongation to a value that was unacceptable to aircraft designers in those days. Today the taboos of low elongation have given way to the more pressing needs of better corrosion resistance and higher strength.

Alcoa obtains the high properties of 2024–T86 by cold-rolling the sheet or plate after solution heat treatment and then artificial aging. This sheet or plate is available up to ½" in thickness, bare or alclad. It is another result of Alcoa's vast experience in research and production. Write for your free copy of *Aluminum Alloys for Elevated Temperature Service.* Aluminum Company of America, 1800-F Alcoa Building, Pittsburgh 19, Pa.

ALWAYS FASTEN ALUMINUM WITH ALCOA ALUMINUM FASTENERS

Your Guide to the Best in Aluminum Value

THE ALCOA HOUR
TELEVISION'S FINEST LIVE DRAMA
ALTERNATE SUNDAY EVENINGS

IN-FLIGHT REFUELING technique for helicopters is demonstrated for the first time by two Marine Corps Sikorsky HRS helicopters. By increasing potential range and payload, aerial refueling can give still greater versatility to the helicopter. The HRS is the Marine Corps version of the Sikorsky S-55, most widely-used transport helicopter.

AROUND THE WORLD WITH SIKORSKY HELICOPTERS

FOURTEEN SEAMEN, five from the bridge, eight from the fantail, and one from the water were saved by an Air Force rescue helicopter when the grounded Japanese freighter *Handa Maru* broke up in 40-foot waves off Honshu, Japan. The Sikorsky H-19 lifted men to safety despite high winds. Note man in rescue sling, circled.

LIFEGUARD FOR TEST PILOTS, Sikorsky S-55 recently purchased by Grumman Aircraft arrives at company's Bethpage, L. I., airfield. Grumman will use the S-55 as a stand-by rescue aircraft while testing its Navy jet fighters off the Atlantic coast. Grumman's S-55 has a 600-pound rescue hoist and flotation gear.

ANTI-SUB SQUADRON HS-5 is first Navy unit being completely equipped with 14 large Sikorsky HSS helicopters. Based at Key West Naval Air Station, the new squadron is first of a number still to be formed which will fly the HSS. Eight pilots and eight crewmen are shown above at Sikorsky Aircraft in Bridgeport, where they were checked out in their new aircraft. The HSS tracks submarines with sonar gear and can launch torpedoes or lay mines. The high-performance helicopter also serves with other armed forces and, in commercial versions, is scheduled for airline passenger service this year in the U. S. and Europe.

HELICOPTER HISTORY

FIRST HELICOPTER AIRMAIL

On May 16, 1943, at the Capitol, U. S. mail was carried by a helicopter for the first time, commemorating the 25th anniversary of airmail. The Sikorsky R-4B was flown by Capt. (now Brig. Gen.) H. Franklin Gregory. Sikorsky helicopters now carry not only mail but freight, express, and passengers in regular daily service.

SIKORSKY AIRCRAFT

BRIDGEPORT, CONNECTICUT

One of the Divisions of United Aircraft Corporation

With your ideas and experience in electronics, it's ten to one you feel the need for a stimulating and vital outlet . . . with real promise for the future.

Here at Philco we welcome men with creative talents . . . men who enjoy seeking out new and unique ways to do things in radar, microwave communications, underwater ordnance, guided missiles and high speed data processing. Great opportunities in electronic and mechanical industrial engineering and research are open to men who apply now.

Even more, Philco has one of the most liberal profit-sharing, retirement and insurance programs in all industry.

ENJOY THESE CONVENIENCES

- Delaware Valley, Center of Industrial Activity
- Choice of City or Suburban Residence
- Unexcelled Transportation—just 20 minutes to Philadelphia's beautiful suburbs
- Abundant Shopping and Entertainment Centers
- New Houses, Apartments
- Schools and Colleges with Highest Ratings
- Near Seashore and Mountain Resorts
- Many Professional Society Chapters

Long Range Industrial and Diverse Military Engineering Fields

• Guided Missiles • Radar • TRANSAC Digital Computers • Underwater Ordnance • Bombing and Fire Control Systems • Servo-Mechanisms • Microwave Communication Systems • Infra-Red Devices • Transistor Circuit Application • Multiplex Equipment • Television Relay Systems • Industrial TV • Color Broadcast Equipment • Forward Scatter Communications • Fire Control Systems • REDAP

Write, Phone Collect, or Apply in person to John F. Morrissey
... Your Inquiry will be held in Strictest Confidence

PHILCO CORPORATION

GOVERNMENT AND INDUSTRIAL DIVISION • PHILADELPHIA 44 PENNSYLVANIA

Seals Designed for Supersonic Speeds

By George L. Christian

New Haven, Conn.—External sealing and molding for canopy cracks, flap edges and other such uses are now being designed and manufactured with the same extreme care that goes into any other part of a supersonic airframe.

The careful attention to streamlining required for high-speed aircraft and the increasing heat generated by modern planes plunging into the thermal barrier are demanding seals which will hold their shapes, be highly scuff-proof, and resist rubber-ruining ozone and temperature extremes ranging from —100F to +500F.

The Connecticut Hard Rubber Co. has developed sealing materials which will meet these demands. In so doing, a company official told Aviation Week, CHR "provides an airframe designer with a rubber sealing material he can use under extreme conditions. Thus he is not faced with the difficult and expensive problem of having to design around a seal."

He added that standard black rubber seals on today's fast aircraft have, in many cases, proved to be completely inadequate. They stick, rip, weather off or just plain fall off.

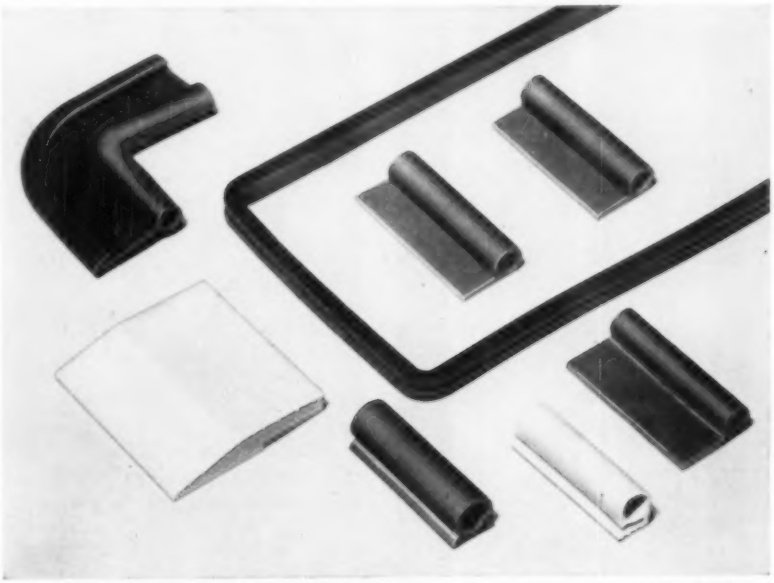
CHR's Cohrlastic

CHR's answer to the sealing problems of supersonic aircraft is a family of silicone rubbers which have the resistance to high and low temperatures inherent in silicone compounds but which have licked to a considerable degree the poor tensile strength usually associated with such compounds.

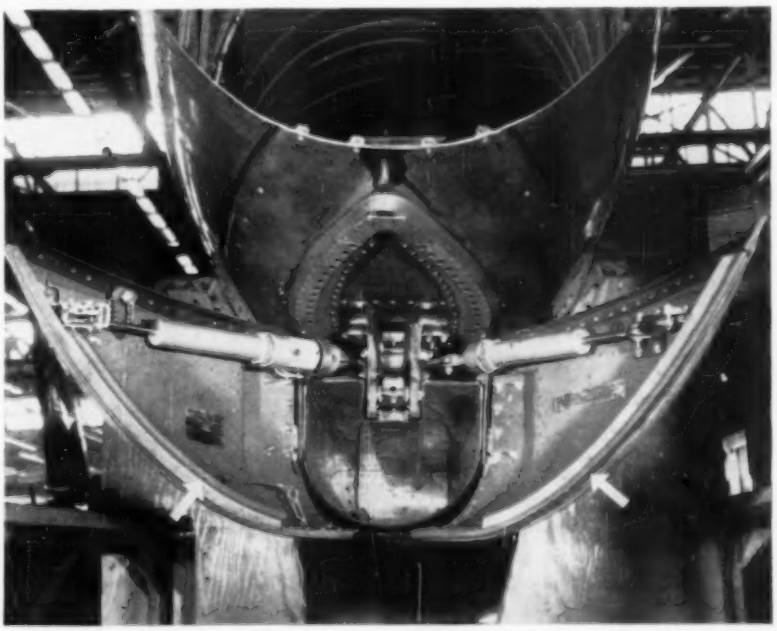
The family name for these silicone rubbers is Cohrlastic. Of this family, Cohrlastic HT-655 and HT-666, used for molded and extruded parts, exhibit tensile strengths in the 1,000-1,650 psi. range. This compares with tensile strengths 400-800 psi. for other silicone rubbers. Neoprene rubber ranges from 1,000-4,000 psi. However, neoprene rubber temperature range is —65 to +300F while CHR's silicone rubbers are good in temperatures ranging from —100F to +500F. They also have indefinite shelf life.

Company spokesmen told Aviation Week that several specifications are already being written around these new silicone rubber compounds by airframe companies.

CHR has many ways of tailoring its rubber products to meet the specialized requirements of its customers.



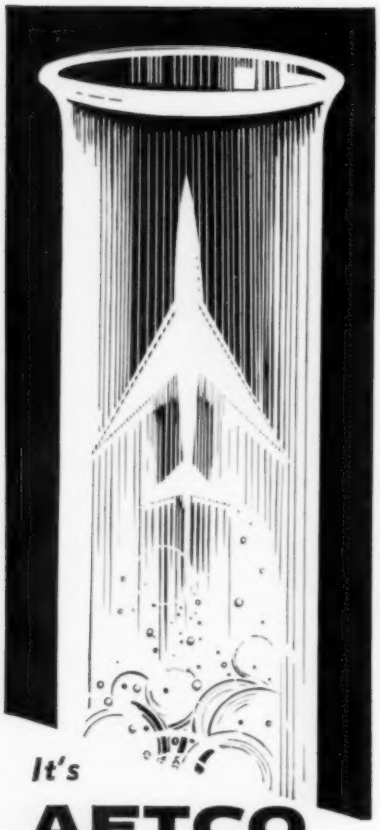
A FEW SAMPLES of the large variety of shapes, sizes and colors in which CHR can make Cohrlastic seals. Flat, white seal (left) is teflon-covered, used on B-47 bomb bays.



CHR seals (arrows) used on drogue chute clam shell doors of Republic Aviation's F-84F act as both weather seals and vibration dampers for hydraulically-operated units.

It mounts its seals on metal or other backing to give rigidity if required. Seals are covered with such materials as dacron to give scuff resistance or teflon to give resistance to aromatic fuels. The seals themselves are made in the form of sheet, sponge, foam or hollow tubing, depending on the application.

CHR supplies sponge rubber in either open cell or closed cell form, the latter being used when water absorp-



It's

AETCO

for complete testing of aircraft components

Aetco is staffed and equipped to test, evaluate, production-test, develop, solve knotty performance problems, and provide certified reports for virtually every aircraft component.

Write for book: "How Aetco can help you."

Aetco

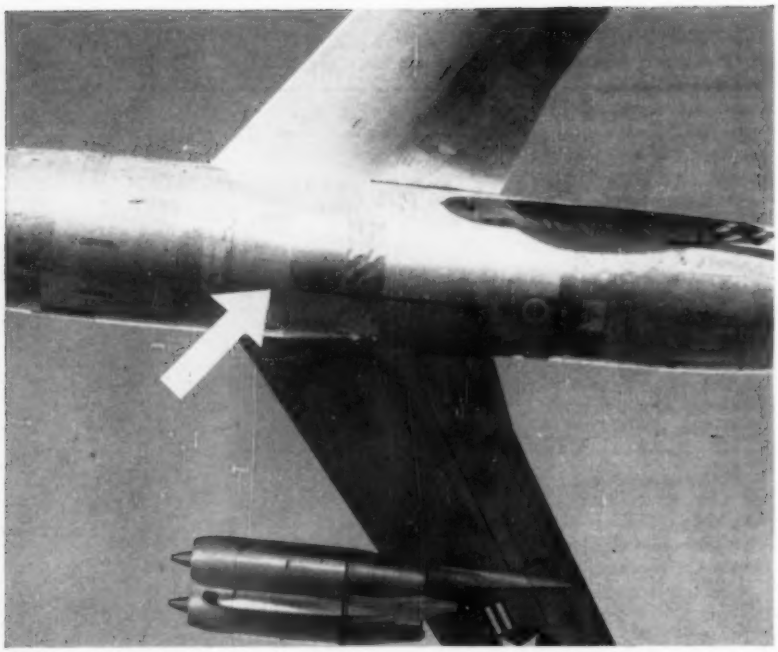
AIRCRAFT EQUIPMENT TESTING COMPANY

1806-12 FLEET STREET
BALTIMORE 31, MD.

America's First Independent Aircraft Testing Laboratory

Hydraulic, pneumatic, electric (400 cycle, AC-DC) and mechanical

IN FLIGHT TESTING!



CHR teflon-covered silicone rubber seals are used to close gap between B-47 bomb bay doors (arrow). Seals must be positive to prevent any break in plane's outer shell.

tion is to be avoided. Foam rubber is available only in open cell form currently.

New aircraft have created new uses for seals. Aerobalance seals, for instance, demand a seal that gives a low coefficient of friction to allow absolutely free surface control movement.

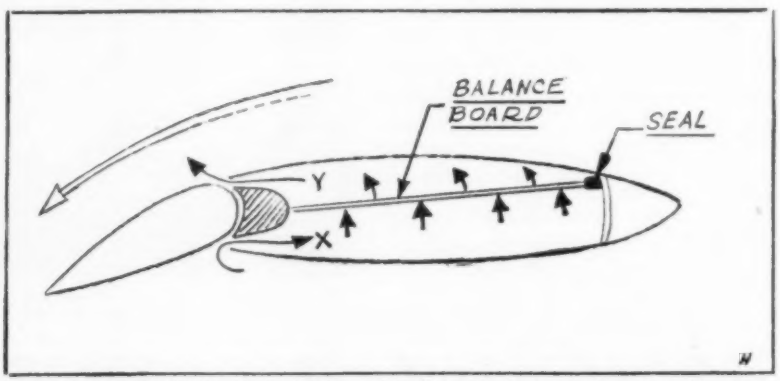
To give seals strength, a non-stick surface and resistance to scuffing, CHR covers them with these various fabrics:

- **Nylon,** if temperature goes to 195F;
- **Orlon,** if temperature goes to 280F;
- **Dacron,** if temperature goes to 350F;
- **Glass fabric,** if temperature goes to 500F.

CHR has available a wide variety of Cohrlastic silicone compounds to meet a wide range of requirements. Among them are compounds which, on a glass base, make good gasketing material, being soft and easily compressible. Other items include compounds with very low temperature resistance (to −125F), flame retarding qualities, and an aluminized silicone finish that is heat reflective and nearly non-combustible. It is self-extinguishing when the flame is removed.

Here are some of the aircraft which use various CHR silicone seals:

- **Douglas A4D.** CHR is supplying inflatable canopy seals (AW April 16 p. 57) which should reduce replacement rate considerably because of their resistance to ozone and weathering deterioration, room temperature flexibility at —80F, and non-stick surface



SCHEMATIC DRAWING of the "balance board" method of aerodynamic rudder boost used in Boeing's 707 and KC-135. As control cable deflects rudder, air pressure in chamber Y is reduced. Unbalance between areas X and Y push board in direction of arrows, helping to move rudder. CHR seals are used to trap air on either side of the board.

WHAT DO YOU KNOW ABOUT AVIATION...

Who Received The First Airmail Letter?

So familiar is this face we silhouetted it to add fun to the game. It was during an extended stay in France that this famous American became interested in the balloon experiments being conducted by French scientists...watching many of the earliest attempts at successful flights. When John Jefferies (an American) and Jean-Pierre Blanchard made the first flight across the English Channel, they delivered the first airmail letter into his hands. His name was Benjamin Franklin.

The early French interest in aviation developed over the years. A century and a half later French pilots inaugurated airmail service across the South Atlantic and to the Far East. This tradition has culminated in the world-wide service of Air France, which annually carries 715 million separate pieces of mail to the peoples of 73 countries.

OVER 4,000 PERSONS A DAY TRAVEL
TO 236 CITIES IN 73 COUNTRIES BY

AIR FRANCE

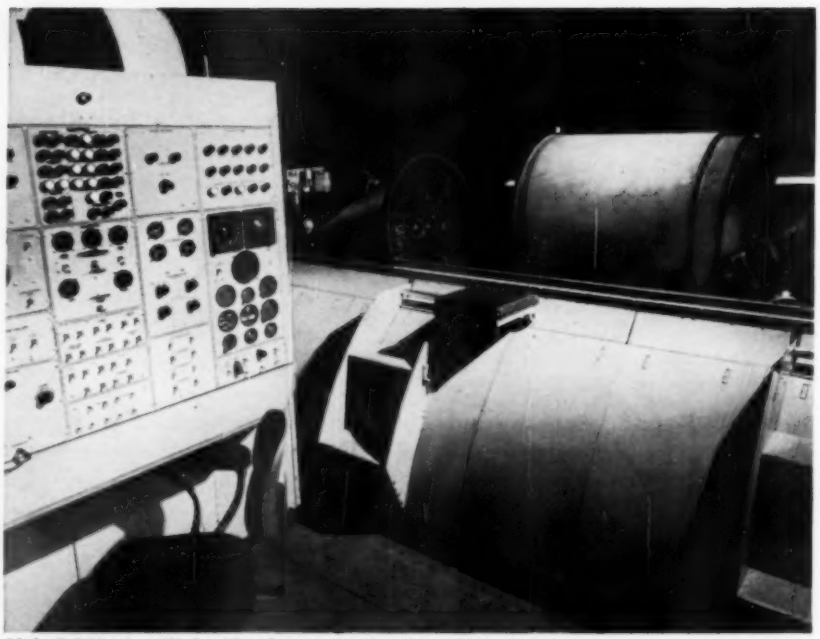
THE WORLD'S LARGEST AIRLINE
WITH 177,740 UNDUPLICATED ROUTE MILES

NEW YORK • ATLANTA • BOSTON • CHICAGO • CLEVELAND • DALLAS • DETROIT • LOS ANGELES • MIAMI • PHILADELPHIA • PITTSBURGH
SAN FRANCISCO • WASHINGTON, D. C. • MEXICO CITY • MONTREAL • TORONTO • VANCOUVER • HAVANA
PUERTO RICO • FORT DE FRANCE • POINTE A PITRE • PANAMA • CARACAS • BOGOTA

ON THE GROUND ONLY SIMULATORS PREPARE PILOTS FOR ALL THESE JET FLIGHT CONDITIONS

To familiarize today's student pilot *completely* with the complex jet he will fly, Link Aviation, Inc. recreates the entire range of flight characteristics in flight simulators.

This complete on-the-ground training is available *only* through simulators — such as this Link F-89D Jet Flight Simulator. Only through them can he experience all flight contingencies, normal and emergency, and thus develop the techniques and skills necessary to operate his plane with a maximum of efficiency.



Link F-89D Jet Flight Simulator, developed by Link Aviation, Inc., in cooperation with the Wright Air Development Center, USAF.

Normal aircraft and engine operation: Flights and missions are simulated in Link's F-89D, duplicating all details of Scorpion performance exactly.

Instrument flying: Personnel learn to use the complex electronic instruments that guide this mighty air weapon in all climates and conditions, day and night.

Crew coordination: Pilot and radar operator train together to fly together more efficiently, making routine and combat "missions" on the ground.

Emergency conditions: Simulated storms, instrument failure and many other flight emergencies train F-89D crews in procedures that could not normally be practiced.

LINK AVIATION, INC.

Pioneer and World's Largest Producer of Jet Flight Simulators

BINGHAMTON, NEW YORK

A SUBSIDIARY OF GENERAL PRECISION EQUIPMENT CORP.

which prevents seal from bonding the fixed and movable sections of the canopy.

• **Boeing 707 and KC-135.** Dacron-covered CHR seals with metal inserts are used to seal gaps between rubber boards and cavities. This allows air to be trapped on both sides of the boards to provide differential pressure and therefore aerodynamic boost to the rudder. Result is that rudder operation can be accomplished with a simple cable control system instead of a heavy, complicated hydraulic boost system.

• **Chance Vought F8U.** CHR aerodynamic seals are used to close the gaps between fin and rudder and aileron ends and wing. Fin/rudder gaps are closed with rub-type seals, while the aileron ends use a small, three-finger type called a "Mickey Mouse" seal (because of its resemblance to cartoon character's gloved hand).

• **North American F-100D and F-107.** Dacron fabric-covered, silicone sponge rubber, tadpole-shaped seals are used to seal the area between inboard edge of the wing flaps and the fuselage. In replacing the previously-used neoprene seal, the dacron-covered unit eliminates binding which had worn off the alclad from that portion of the fuselage. The dacron-covered seals showed no signs of wear after tests simulating 1,000 hours of flap movement, according to CHR.

• **Douglas B66B and RB66B.** Dacron fabric-covered silicone rubber "bath tub" seal is used on the lower forward fuselage access door where it must resist extreme abrasion.

• **Republic F-84F.** Clam shell doors on the drogue chute housing mounted on the after, rear section of the fuselage use CHR seals both as weather seals and vibration dampers. The extruded sponge seal at the fuselage eliminates a more complicated alternate seal under consideration, according to CHR, while pieces of sponge rubber sheet at door corners offer dynamic cushioning for the hydraulically-operated doors as they close.

• **Boeing B-47.** The planes' bomb bay seals are made of 2¼ in. wide silicone rubber sheathed in thin, white teflon covering to provide resistance to abrasion and fuels. The seals must be positive to prevent any break in the plane's "outer shell" which might create turbulence and therefore air resistance.

• **Lockheed P2V-7.** Also uses teflon-covered silicone rubber seals to seal the eyelids on the jet pods slung under the planes' wings.

CHR officials point out that, while their Cohrlastic rubber products cost about 7-10 times as much as organic rubber products (basic gum costs $3-4 a pound), the greatly increased uses of the products usually far outweigh the additional cost.

As a graduate

B.S.E.E.

or

B.S.M.E.

WORK WHERE THE NEED FOR ENVIRONMENTAL TEST ENGINEERS IS URGENT

You will work at the very forefront of guided missile development... perform environmental tests on a wide variety of electronic and mechanical components... analyze test data... recommend solutions for problems encountered in engineering design. Your individual contribution will be vital in the progress of many important projects.

Write or Contact direct: Mr. R. C. Smith, Autonetics Engineering Personnel Office, Dpt. 991-20 AW, 12214 P.O. Box AN Bellflower, Calif.

Autonetics

A DIVISION OF NORTH AMERICAN AVIATION, INC.

AUTOMATIC CONTROLS MAN HAS NEVER BUILT BEFORE

FOR INSURED ACCURACY OF AIRCRAFT TEMPERATURE INDICATORS

use the LEWIS 81T26 THERMOMETER TESTER

A PORTABLE PRECISION MULTIPLEX INSTRUMENT

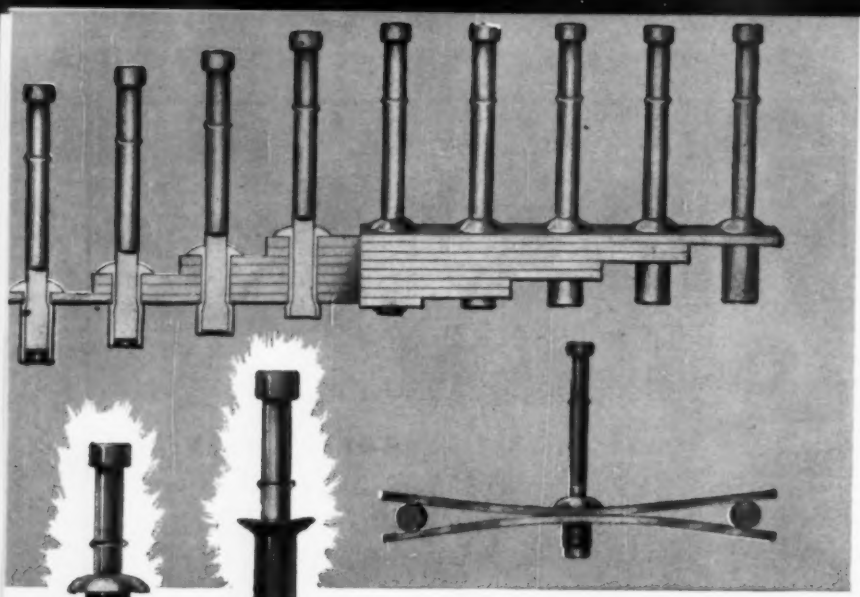
USAF TYPE N3 TO MIL-T-7449

FOR TESTING IRON-CONSTANTAN, COPPER-CONSTANTAN OR CHROMEL-ALUMEL THERMOCOUPLE INDICATORS AND ELECTRICAL RESISTANCE THERMOMETERS CALIBRATED TO THE AN-B-19 OR AN-B-31 TEMPERATURE-RESISTANCE CURVES.

FOR USE IN THE TEST LABORATORY . . . OR IN THE AIRCRAFT

the LEWIS ENGINEERING COMPANY

naugatuck, connecticut



Excellent hole filling characteristics of Cherry "700" rivet are shown in cross section photo above. Test piece also demonstrates that various material thicknesses can be riveted successfully with rivets of identical length. Lower illustration shows high clinch attained with "700" rivet.

Versatile Cherry "700" Rivet Provides New Uniform Fastening Method

The hole filling qualities, wide grip range, high clinch, and positive stem retention now possible with the new Cherry "700" rivet give the aircraft industry a uniformity of fastening never before available.

In the past, variations in hole diameter made it virtually impossible to completely fill the hole in every instance. This difficulty is eliminated with the "700" rivet which always adjusts to fill the hole and provides high stem retention.

The method of setting the "700" rivet also provides high clinch and makes it possible to use one length to fasten a wider range of material thicknesses. Positive inspection is easy since a properly set rivet is indicated by the amount of stem shoulder protruding above the rivet head.

The "700" rivet is available in countersunk and universal head styles in a wide range of diameters and lengths. It is installed with standard Cherry rivet guns with controlled-stroke pulling heads and accessories.

A product of the Cherry Research and Development Department, the "700" rivet has back of it years of fastening experience in the aircraft industry. This organization has developed the widest range of types and sizes available in the industry. Cherry engineers have designed and built special purpose machines and developed techniques that make possible such innovations as the "700" rivet.

For technical data on how the Cherry "700" rivet will give you a more uniform method of fastening, write to Townsend Company, Cherry Rivet Division, P. O. Box 2157-N, Santa Ana, California.

CHERRY RIVET DIVISION

SANTA ANA, CALIFORNIA

Townsend Company

ESTABLISHED 1816 • NEW BRIGHTON, PA.

In Canada: *Parmenter & Bulloch Manufacturing Company, Ltd., Gananoque, Ontario*

OFF THE LINE

A report detailing how a major airline engine overhaul facility hiked its output from 5.4 engines in 1½ shifts to 10 engines in a single shift is available from the Rapids-Standard Co., Inc. The document, Field Report No. 95, includes sketches of the conveyor layout and photos of the equipment in operation. Address: 342 Rapistan Building, Grand Rapids 2, Michigan.

Celastic (AW Aug. 31, 1953, p. 46), a colloidal treated plastic, is being used by Pan American World Airways to provide scuff resistance to the cargo compartment flooring of its fleet of Atlantic and Latin American division DC-6 and DC-7 aircraft. PAA saves 14 lb. per plane by replacing fiberglas baggage compartment flooring with Celastic. Cost is about $400 per installation. Address: Calahan & Horsey, Inc., 551 Fifth Ave., New York 17.

National Water Lift Co. (AW Jan. 9, p. 54) is doubling its present aircraft hydraulic research and development testing facilities. Included in the new laboratories will be equipment to duplicate the high temperatures encountered in supersonic jet and rocket flight. NWL is a division of The Cleveland Pneumatic Tool Co.

Additional $1.7 million of hose reel units for aerial refueling have been ordered from Flight Refueling, Inc., Baltimore for installation on KB-50 tankers.

Aeronautical Division of Minneapolis-Honeywell Regulator Co. received a $9.8 million follow-on contract to supply additional MB-3 autopilot systems to the USAF and North American Aviation for the F-100F. Exact amount involved was not announced, other than it was a "multi-million dollar" order.

Drift meters made by the British firm Kelvin Hughes will be installed in all 33 Bristol Britannias being bought by British Overseas Airways Corporation. The instruments can be used both to measure drift and to determine ground speed. The device extends only three in. from the plane's fuselage when in use and can be retracted to fit flush with the outer skin when not in use. The drift meter mounting can withstand a differential pressure of 8.5 lb./sq. in. and it also incorporates an electric heater.

Britain's first jet engine silencer capable of accommodating twin jet airplanes is now in use by Hawker Sid-

deley to quiet ground testing of its delta wing Gloster Javelin all-weather fighters being delivered to the RAF. The $70,000 structure surrounds the plane with soundproof walls 16 ft. high to eliminate the noise. A 76 ft. long silencer dims the engine noise.

New orders totalling $24 million have been received during the first four months of 1956 by Lear, Inc., increasing the company's total backlog to $58 million.

USAF Contracts

Following is a list of unclassified contracts for $25,000 and over as released by Air Force Contracting Offices:

MOBILE AIR MATERIEL AREA, Brookley AFB, Ala.

General Electric Co., Stortber Field, Arkansas City, Kans., overhaul and modification of starters, type S-12 (Contract AF 01(601)19649 Class 03J), 445, $159,745.

Bendix Aviation Corp., Utica, Div., repair and modification of switch assemblies, part Nos. 872153 and 881354, (Contract AF 01(601)19653 Class 03J), 1150, $31,130.

Weston Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark 4, N. J., ammeter and voltmeter, 3248 ea., PR MA (598437) RFP, $83,520.

Weston Electrical Instrument Corp., 614 Frelinghupsen Ave., Newark 4, N. J., ammenter, 3042 ea., PR MA (598780) (662561) RFP, $41,273.

DAYTON AF DEPOT, Gentile AF Station, Dayton 10, Ohio.

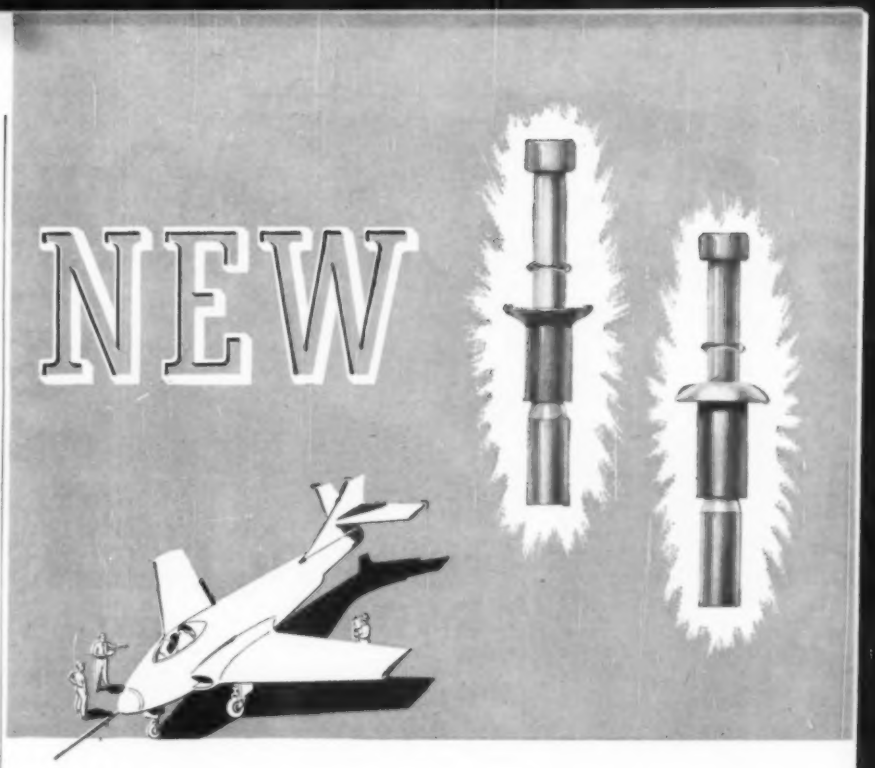
Meletron Corp., 950 N. Highland Ave., Los Angeles 38, Calif., switch-pressure, SPDT, Meletron P/N 410-15BL80, 280 ea., switch-pressure SPST Meletron P/N 150A, 750 ea., switch-pressure SPDT Meletron P/N 1514-15-10, 4520 ea., switch-pressure SPDT Meletron P/N 410-10113, 950 ea., switch-pressure Meletron P/N 417-15BL4, 350 ea., switch-pressure SPDT Meletron P/N 1510-50, 414 ea., switch-pressure pile up type Meletron Corp No Model 1413, 125 ea., switch-pressure SPST Meletron 1512-15-23A, 200 ea., switch-pressure SPDT Meletron P-N 1512-11-49, 100 ea., switch-pressure SPDT Boeing P/N 10-778-8, Meletron P/N 410 E-10 DBL-264A, 100 ea., switch-press SPDT Boeing P/N 10-1693-2, Meletron P/N 4101E-21B-23, 100 ea., switch-press SPDT Meletron P/N 410A21DL-154 Douglas Acft 7378757505, 100 ea., switch-press SPDT Meletron P/N 410-15B-95, 200 ea., switch-pressure SPDT Meletron P/N 410-10L2, 200 ea., switch-press SPDT Meletron P/N 410-15B50, 100 ea., switch-press SPDT Convair P/N SW411 Meletron P/N 4128BL37, 200 ea., switch-press SPDT Meletron P/N 410121B1, 100 ea., (RFP 33-604-56-2364), various, $340,953.

AiResearch Mfg Co., a Div. of Garrett Corp., 9851 Sepulveda, Los Angeles 45, Calif., four types of spare parts necessary to repair switches as follows: insulation sheet, elect fiberglass non adhesive airesearch P/N S8192-3B010, 2500 ea., nut, coupling elect condult alum anod Airesearch P/N 12600, 2500 ea., packing, performed rubber syn Airesearch P/N 12702, 8000 ea., (FR-639322), $35,480.

Sylvania Electric Prod., Inc., 1740 Broadway, New York, N. Y., tube electron receiving triode, tube type 5751WA in a/w spec MIL-E-1B dtd 2 May 52, amdt Nr 3 thereto dtd 12 Nov 53, 50000 ea., (RFP 33-604-56-1264), $85,000.

Tung-Sol Electric, Inc., 95 Eighth Ave., Newark 4, N. J., tube-electron, receiving, JAN type 6098/6AR6WA in a/w spec MIL-E-1B dtd 2 May 52, Amdt Nr 3 therto dtd 12 Nov 53, spec sheet MIL-E-1 204A dtd 16 July 54, 23000 ea., (RFP 33-604-56-1264), $184,000.

General Electric Supply Co., 601 E. Third St., Dayton 2, Ohio, ammeter-recording AC 60 cyc range 0 to 300-600 amp range, GE



NEW CHERRY "700" Aircraft Rivet

Gives More Effective Fastening

A new, more effective fastener for the aircraft industry has been developed and is now being produced at the Cherry Rivet plant in Santa Ana, California. Designated the Cherry "700," the new rivet provides a wide grip range, positive hole fill, high clinch, uniform stem retention and permits 100% positive inspection.

The "700" rivet is versatile and in many cases one length of each diameter will cover all thicknesses of material. Also, the sheet hole size is not critical as with other rivets since the design provides positive hole fill even in oversize holes. The stem always adjusts to fill the hole which affords high stem retention independent of hole size.

The manner in which the "700" rivet is set provides high clinch by drawing the sheets together tightly and uniformly. When the "700" rivet is set, the stem shoulder protrudes above the rivet head and gives visual indication that the blind upset is properly formed, the sheet hole is filled and the rivet is properly set.

This latest fastener advancement is a typical example of how the Cherry Division has paced the industry with new and improved fasteners and the tools and accessories for applying them—all of which are designed, developed and produced in the Santa Ana plant.

This plant is devoted exclusively to the manufacture of products for the aircraft industry.

For information, write for the new Cherry "700" bulletin to Townsend Company, Cherry Rivet Division, P.O. Box 2157-N, Santa Ana, California.

CHERRY RIVET DIVISION

SANTA ANA, CALIFORNIA

Townsend Company

ESTABLISHED 1816 • NEW BRIGHTON, PA.

In Canada: *Parmenter & Bulloch Manufacturing Company, Ltd., Gananoque, Ontario*

pip® SELF-LOCKING QUICK-RELEASE PINS

. . . MAKE AN OPEN AND SHUT CASE OF

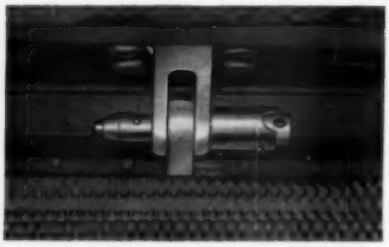
Patented

PIP — Reg. U.S. Pat. Off.

SPEEDING *DOUGLAS* F4D MAINTENANCE!

Fast removal and replacement of ventral access door is accomplished with "B" Series PIP pins. Through quick access, powerplant and systems maintenance time on the Navy's Douglas F4D aircraft is reduced!

This PIP pin application replaces other methods requiring nuts, bolts and cotter pins. Door installation and removal time is fast and simple as PIP pins are easily driven in or out of the fittings and automatically correct for hole misalignment caused by normal structural flexibility. *Safety and ease of use are increased!*



The large powerplant access door utilizes ten "B" Series PIP drive-in, drive-out pins in the hinge-type attachments as shown in photo. Locking is positive and automatic!

PIP pins are available in sizes to most bolt standards and in "T," "L," Ring and Button head styles. For complete information write for Bulletin ADI-5500.

AVIATION DEVELOPMENTS INC.

210 SOUTH VICTORY BOULEVARD, BURBANK, CALIFORNIA

Burbank • Chicago • Denver • Fort Worth • Kansas City • London, England • New York • San Francisco • Seattle • Toronto, Canada • Wichita

P/N G-4 W-10 ft leads GE Model 411 X 29, type G-4, 150 ea., (RFP 33-604-56-2072), $32,850.

Herbach & Radman, Inc., 1204 Arch St., Philadelphia 7, Pa., solenoid-electrical pull-type cannon electric development Co., type 1700-3, 4000 ea., Solenoid-elec rotary HAG 420-69-0357, AN/APG-37, 300 ea., (RFP 33-604-56-1846), $32,467.

Stelma, Inc., 190 Henry St., Stamford, Conn., telegraph distortion analizer Model TDA Stelma Inc., 120 ea., (RFP 33-604-56-1936), $48,120.

Collins Radio Co., 855 35th St., N.E., Cedar Rapids, Iowa, six items of misc parts for airborne radar equipment, var quantities, $28,692.

Collins Radio Co., 855 35th St., N.E., Cedar Rapids, Iowa, ten (10) items of misc parts for airborne radio communication equipment, var quantities, $91,980.

Collins Radio Co., 855 35th St., N.E., Cedar Rapids, Iowa, sixty-one (61) items of misc parts for airborne radar equipment also coils, transformers, rectifiers, knobs and dials, $61,959.

OGDEN AIR MATERIEL AREA, Hill AFB, Utah.

American Bosch Arma Corp., American Bosch Div., 3664 Main St., Springfield 7, Mass., actuator assy, hyd operated, 300 ea (1 item, RFP-00-542962), $28,536.

Lockheed Aircraft Corp., California Div., Burbank, Calif., Overhaul Instructions with parts breakdown (6 items RFP-00-497157), $53,757.

Westinghouse Air Brake Co., Union Switch & Signal Div., Swissdale, Pa., modification of flight simulators, (1 item, RFP-00-371107, and RFP-00-217194), $2,121,515.

SAN ANTONIO AMA, Kelly AFB, Tex.

Titeflex, Inc., 500 Frelinghuysen Ave., Newark, N. J., 4718-91374 kit "B", 578 ea., Contract No. AF41(608)-7677 (PUR. REQ: SA-611019 (1st partial), SA-611019-1 (1st final), $999,887.

OKLAHOMA CITY AMA, Tinker AFB, Okla.

Lockheed Aircraft Corp., Marietta, Ga., Modification and IRAN of 52 each B-47E type aircraft, (IFB OC-705531, OC-705531-C2, OC-705531-C1, OC-705531-C3), job, $2,000,000.

General Motors Corp., Allison Div., Indianapolis, Ind., Overhaul of YT-56-A-3 and/or T56-A-1 engines and/or component assemblies, (IFB OC-585524, OC-585524-C1, OC-585524-C2 & OC-585524-C3), job, $1,222,000.

AIR FORCE MISSILE TEST CENTER, Patrick Air Force Base (ARDC), Fla.

Miligo Electronic Corp., 7601 Northwest 37th Ave., Miami 47, Fla., design, fabrication and installation of a Model II firing system, (PR No. FP-1(56)271), job, $157,161.

Houston Fearies Div., Color Corp. of America, 11801 W. Olympic Blvd., Los Angeles 64, Calif., remote control parabola, 12 ea., (FP-1(56)328), $52,010.

Ampex Corp., 710 Peachtree, N.E., Atlanta 8, Ga., tape, 1790 NL831210-65, 15Orls; tape 1790 NL831210-6, 4547 rls; (PRSs AF-16-N-IV-LP-56-3950, AF-16-N-IV-LP--56-3957, AF-16-N-IV-LP-56-3986, PR-16-N-IV-56-20,001), $46,328.

Electronic Engineering Co. of Calif., 180 S. Alvarado St., Los Angeles, Calif., increase in quantity of equipment to be supplied, (PR FP-1(56)246), job, $175,660.

Canoga Corp., 5955 Sepulveda Blvd., Van Nuys, Calif., increase in funds allotted on contract AF 08 (606)-709 (PR FP-1(56)-269), $153,264.

AF OFFICE OF SCIENTIFIC RESEARCH, ARDC, P. O. Box 1395, Baltimore 3, Md.

Oklahoma Agricultural and Mechanical College Research Foundation, Stillwater, Okla., research—investigation of semiconducting properties of type IIb diamonds, (AF 18-(603)-40), job, $33,268.

University of Cincinnati, Cincinnati 21, Ohio, research—fundamental study of adhesion of polymeric materials to solids, (AF 18(600)-1141), job, $29,903.

Massachusetts General Hospital, Boston, Mass., research—alterations of central

nervous system function by focused ultrasound, (AF 18(603)-13), job, $28,600.

Polytechnic Institute of Brooklyn, 99 Livingston St., Brooklyn 1, N. Y., research-three dimensional supersonic and hypersonic flow and related testing problems, (AF 18(600)-693), job, $115,000.

Cornell University, Ithaca, N. Y., research in analysis, (AF 18(600)-685), job, $125,-095.

The John Hopkins University, 34th and Charles Sts., Baltimore 18, Md., research—turbulent boundry layers and similar nonlinear phenomena, (AF 18(600)-671), job, $57,230.

The Pennsylvania State University, University Park, Pa., research—crystal-structural bases for some physical properties of crystalline solids, (AF 18(603)-35, job, $89,012.

WARNER ROBINS AMA, Robins AFB, Ga.

Sperry Gyroscope Co., Great Neck, L. I., N. Y. modification kits for Types A-1A and ME-5 bombing navigational computers, (PR-407956), $83,791.

Aircraft Tools, Inc., 9030 Bellanca Ave., Los Angeles, Calif., dimpling machines, stationary, 12 ea., (IFB-304), $33,153.

Beech Aircraft Corp., Wichita, Kans., propeller assemblies, metal blades and pitch controls, (PR-R-56-8474), $160,985.

AC Spark Plug Div., GMC, Milwaukee, Wis., modification kits for ME-2, ME-5 and A-14 computers, (PR-407929 and 681231), $37,319.

Gowdy and Durkin, Inc., 671 Tenth St., N.W., Atlanta, Ga., repair of baffles in engine test cells (IFB51), $73,940.

Motorola, Inc., 2710 N. Clybourn Ave., Chicago 14, Ill., modification kits for aircraft radar systems, $78,476.

Servomechanisms, Inc., Hawthorne, Calif., reproducible handbook copy for maintenance and overhaul of angle of attack computers, (PR-584502), $30,230.

Engineering Products Div., RCA, Camden, N. J., modification kits for aircraft radar and flight data computers, (PR-427-588 abd 431243), $38,567.

General Electric Company, Johnson City, N. Y., modification kits for B-36 and A-5 fire control systems, (PR-433557, 433559 and 533560), $308,540.

SACRAMENTO AMA, McClellan AFB, McClellan, Calif.

Hartman Electrical Manufacturing Co., 175 N. Diamond St., Mansfield, Ohio, panel, P/N 8211-A861, relay P/N 8211-A862A, comptroller, P/N 8211-MC815, items applicable to MC-3 gen set, (P/R 5216-1- contract No. AF 04(606)-4830), $75,034.

Esseo Div. of H. K. Porter Co., Inc., of Pittsburgh, 11 Third Ave., Joliet, Ill., lead assy electrical, P/N 8211-7141, cable assy P/N 8211-7175 cable assy, P/N 8211-7197-1, items applicable to MA2 electrical support system, (P/R 5267-contract No. 04 (606)-4706), $126,523.

AMC Wright-Patterson AFB, Ohio.

Simmon Brothers, Inc., 30-28 Starr Ave., Long Island City, N. Y., enlarger photographs NF-1, 17 ea., (MIPR R56-50-23375-6-ASO), $31,450.

Gordon Enterprises, 5362 North Cahuenga Blvd., North Hollywood, Calif., spare parts for type K-38 camera, (PR 664078), $41,854.

Camera Equipment Co., 1600 Broadway, N. Y. 19, N. Y., tripod, balanced TV type, 63 ea., (MIPR R56-51-23375-G 6/1, 2, 6/ASO), $26,909.

Kearfoot Co., Inc., 1378 Main Ave., Clifton, N. J., spare parts for aircraft camera mount, component of C9P-5005, gyroscope vertical type A-1, 36 ea. (MIPR R56-104-23375 G6/6/ASO and PR 664107-MO, $91,-800.

Weston Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark 5, N. J., type MJ-4 temperature indicators, 921 ea. (PR 635857), $33,563.

Webster-Chicago Corp., 816 North Kedzie Ave., Chicago 51, Ill., case, chaff dispenser AN/ALE-2, 1082 ea., intervalometer, 1082 ea., stripper, 1082 ea., control 1082 ea., (PR-GE-561212 and GE-561212-1), $1,889,-702.

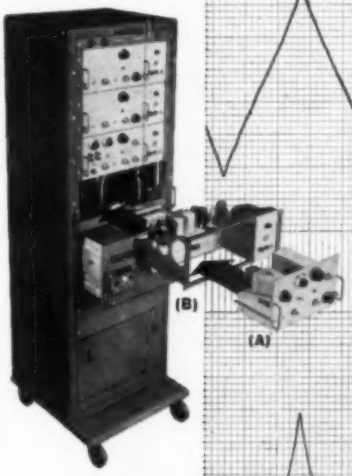
Massachusetts Institute of Technology, Cambridge 39, Mass., facilities in support of project MX-1593, (PR 226000), $45,000.

SANBORN *Recording Permapaper*

ALL SANBORN 150 SERIES OSCILLOGRAPHIC RECORDERS PROVIDE THESE

SPECIFIC ADVANTAGES

The three foremost operating advantages of a Sanborn "150" are evident in the record, and are given at the right. Equally popular with industrial users is the *wide versatility* of these systems. Each one comprises a basic assembly to which the user adds his choice of an interchangeable, plug-in type preamplifier for each channel. Presently available different preamplifiers now number *eleven.*



Preamplifier (A) shown in position to plug into a Driver Amplifier with Power Supply (B) which are normally already in place in the Basic Cabinet Assembly

Rectangular Coordinate Recording

is a Sanborn feature that is especially valuable in multi-channel recording. The user of a 2-, 4-, 6- or 8-channel "150" system can record interrelated events simultaneously on one strip of record paper, and then correlate them against time quickly and accurately, even during the recording.

Clear, Sharp, Inkless Tracings

The nichrome ribbon tip "150" heated stylus removes the white opaque surface of Sanborn recording paper (Permapaper) permitting the black undercoating to show. Tracings are permanent, will not fade or smudge.

Improved Over-all Linearity

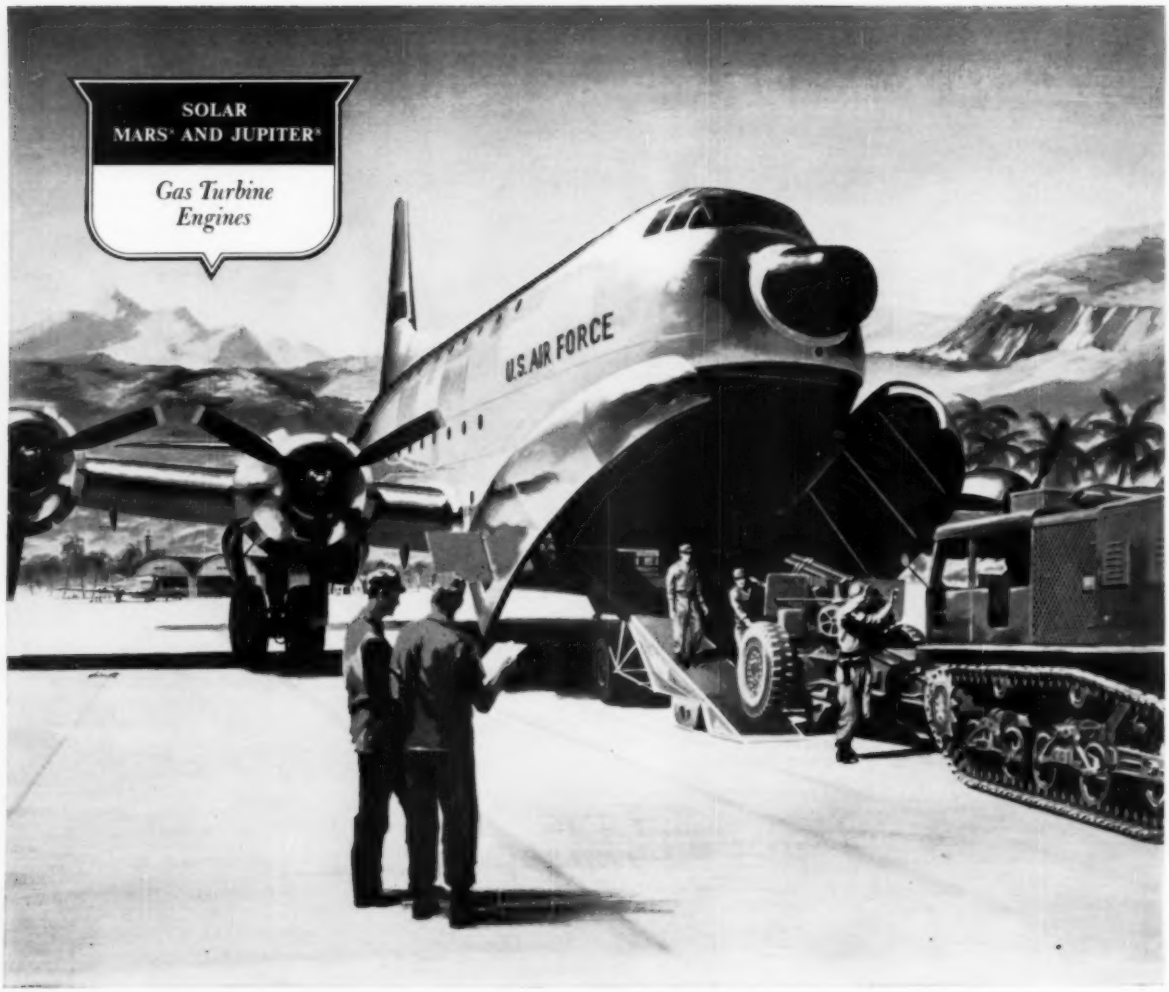
resulting from current feedback design of Driver Amplifiers and new shorted coil frame, high torque (200,000 dyne cm.) galvanometers. Maximum error over middle 4 cm. of chart: 0.25 mm . . . over entire 5 cm. chart width: 0.5 mm.

INDUSTRIAL DIVISION

SANBORN CO.

195 Massachusetts Ave., Cambridge Mass.

A new "150" Catalog provides complete descriptive data, specifications and prices on all 150 Systems, Accessories and Cabinets. A copy will be sent on request.



Tiny gas turbine provides vital power for giant air freighter

HUGE GLOBEMASTERS depend on Solar Mars gas turbines as a vital auxiliary power source. Built into an airborne generator, the Mars provides power to operate cargo winches, ramps, lights, engine starters and other equipment. Specified on the Douglas C-124C, the Mars unit is also used on the Lockheed C-121C, the Convair C-131B, and the Boeing KC-97.

Military services and aircraft builders recognize the amazing advantages of Solar gas turbines. Their reliability is proven. They are rugged and simple, light and compact, and easy to maintain. Solar builds two models—the 50 hp Mars and the 500 hp Jupiter—for varied applications.

You should know about Solar gas turbines. And you should know about Solar—a company with 30 years of experience in using tough alloys to solve tough engineering and fabricating problems. For more information, write Dept. C-31, Solar Aircraft Company, San Diego 12, California.

WRITE FOR BOOKLET...new brochure describes Solar gas turbines—how they work, advantages they offer to forward-looking industries. Send for a copy today.

SOLAR
AIRCRAFT COMPANY
SAN DIEGO DES MOINES

ENGINEERS WANTED *Unlimited opportunities in Solar's expanding gas turbine program! Write today, giving experience.*

Designers, Developers and Manufacturers • Gas Turbines • Aircraft and Missile Components • Bellows • Controls • Coatings • Metal Alloy Products

Army Contracts

Following is a list of unclassified contracts for $25,000 and over, as released by Army Contracting Offices:

CORPS OF ENGINEERS, Office of the District Engineer, Mobile District, 2301 Grant St., Mobile, Ala.

Ralph M. Parsons Co., Los Angeles, Calif., architect-engineer services for development of criteria and preliminary design of ABMA facilities, FY-57 army program at Redstone Arsenal, Huntsville, Ala., Negotiated, job, $189,000.

LOS ANGELES ORDNANCE DISTRICT, 55 S. Grand Ave., Pasadena 2, Calif.

Firestone Tire & Rubber Co., 2525 Firestone Blvd., Los Angeles 54, Calif., engineering services related to the Corporal Missile Program, job, $1,000,000.

Motorola, Inc., Riverside Research Laboratory, 8330 Indiana Ave., Riverside, Calif., fuze ETSQ feasibility study, job, $33,756.

Gilfillan Bros., Inc., 1815 Venice Blvd., Los Angeles 6, Calif., engineering services related to the Corporal Missile System, job, $2,672,278.

Navy Contracts

Following is a list of unclassified contracts of $25,000 and over as released by Navy Contracting Offices:

OFFICE OF NAVAL RESEARCH, Special Devices Center, Port Washington, N. Y.

The Reflectone Corp., Stamford, Conn., design, development and construction of carrier landing trainer, Nonr-1960, $83,948.

Dyna-Empire, Inc., Garden City, N. Y., design study and engineering model of helicopter main rotor blade tracking device, Nonr-1954, $43,209.

AVIATION SUPPLY OFFICE, 700 Robins Ave., Philadelphia 11, Pa.

Jaegle Paint & Varnish, 1607 S. 20th St., Philadelphia 45, Pa., primer (IFB-383-776-56), 5700 gal., $27,551.

Aviators Clothing Co., Inc., 143 Main St., Beacon, N. Y., pararaft kit, (IFB-383-517-56), 1810 ea., $153,452.

New York Rubber Corp., 100 Park Ave., N. Y. 17, N. Y., pneumatic raft, (IFB-383-727-56), various, $916,123.

Malabar Mfg. Co., 950 Doolittle Dr., San Leandro, Calif., aviation jacks, (IFB-383-188-56), various, $155,350.

Aviators Clothing Co., Inc., 143 Main St., Beacon, N. Y., summer flying suits, (IFB-383-429-56), 25770 ea., $306,148.

Holley Carburetor Co., 11955 E. Nine Mile Rd., Van Dyke, Mich., fuel controls, (383/2117-148/50), 898 ea., $1,088,196.

Scintilla Div., Bendix Aviation Corp., Sherman Ave., Sidney, N. Y., maintenance parts, (383/2116-109X5/4/53), various, $63,650.

Scintilla Div., Bendix Aviation Corp., Sherman Ave., Sidney, N. Y., maintenance parts (383/2116-123/53), various, $70,558.

C. K. Williams & Co., 640 N. 13th St., Easton, Pa., cuprous oxide (155/380052F/56), 57800 lbs., $40,027.

Lockheed Aircraft Corp., P.O. Box 551, Burbank, Calif., ground handling equipment for TV A/C, (383/2110-1424/52), various, $54,229.

Waukesha Motor Co., Waukesha, Wis., auxiliary power plant, (383/29065-70S2/2/56, CG 1110-56-40, CG 776-56-40), 112 ea., $168,514.

Chandler Evans Div., Pratt & Whitney Co., Inc., W. Hartford 1, Conn., diaphragm sys., (383/2116-116/X3/4/53, various, $66,-299.

Sundstrand Aviation Div., Sundstrand Machine Tool Co., 2421 Eleventh St., Rockford 1, Ill., torque limiting adapters, PREN-11-2727/55), various, $111,265.

Sundstrand Aviation Div., 2421 Eleventh St., Rockford, Ill., wobbler asy., (383/2150-586/53, 383/2150-208/54), various, $231,823.

Whirlpool-Seeger Corp., 850 Arcade St., St. Paul, Minn., parts for F-J 2, A/C, (383/29011-61A3/3/56), various, $2,818,475.

General Electric Co., 1405 Locust St., Philadelphia 2, Pa., line maintenance testers, (383/29067-16S2/3/4/56), 99 ea., $31,-260.

Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J., compass & indicators, (383/2120-65/54), various, $40,009.

Red Band Div., Bendix Aviation, Eatontown, N. J., assys. for (R6D-1, 12 A/C, 383/2140-467X2/4/52), various, $87,705.

Duracote Corp., 350 N. Diamond St., Ravenna, Ohio, fiberglas cloth, floor covering, (383/29081-1072G3/3/56), various, $43,304.

Barber-Colman Co., Rockford, Ill., throttle actuators, (383/2110-1477/50, 383/2110-119, 54, 383/2110-21/55), 38 ea., $41,899.

Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J., controller transmitters, (PREN11-4688/56), various, $94,-351.

Atlas Paint & Varnish Co., 32-50 Bluffington Ave., Irvington 11, N. J., enamel, (IFB-383-580-56), 25500 gal., $58,265.

United States Gauge Div., American Machine & Metals, Inc., Sellersville, Pa., manifold pressure transmitters, (IFB-383-683-56), 1095 ea., $77,748.

H. H. Robertson Co., 2400 Farmers Bank Bldg., Pittsburgh, Pa., pigment, (IFB-383-975-56), 196600 lbs, $111,634.

Reliance Chemical Co., Lee Terminal-Standiford Field, Louisville 13, Ky., enamel, (IFB-383-580-56), 85100 gal., $196,060.

BUREAU OF AERONAUTICS, Washington 25, D. C.

Raymond Rosen Eng. Products, Inc., 32nd & Walnut Streets, Philadelphia 4, Pa., furnish qualified technically, trained employees for installing modification kits in UKR-5 telemetering ground stations, NOas 56-233-s (EL-42-2644-56), 72 Man months, $119,460.

Servo Corp. of America, 20-20 Jericho Turnpike, New Hyde Park, N. Y., plotting boards, computer and amplifiers, latitude and longitude indicators, NOas 56-281-f (PD-42-1272-56 & Change A), $1,111,925.

TEAMWORK
Whittaker gyros are designed and built by a staff of engineers and technicians that has remained practically intact for more than a decade.
By working together, they have been able to produce gyros that are unsurpassed for strength, accuracy and reliability. The proof is in Whittaker's overall customer rejection of less than 2%.
Whittaker Gyro
DIVISION OF TELECOMPUTING CORPORATION
VAN NUYS, CALIFORNIA
STANLEY 7-5511

The Civil Servant is "the man behind the man behind" . . . he evaluates equipment . . . influences technical decisions . . . and renders to our experienced engineers timely knowledge which makes progress possible.

He formulates the exacting specifications for specific electronic equipment . . . He is the man whose experience will help achieve the vital objective of OPERATIONAL RELIABILITY. This is teamwork . . . the indispensable ingredient which assures the quality of military systems which this company produces.

At LMEED . . .
as everywhere in General Electric
PROGRESS IS OUR MOST IMPORTANT PRODUCT

In Aviation Electronics

LMEED

Products Include:

FIRE CONTROL RADAR
SEARCH RADAR
INDICATORS AND DISPLAY
COUNTERMEASURES
NAVIGATION
MISSILE CONTROL
AIRBORNE SONAR
COMMUNICATIONS
FUZES
AUTOMATIC TEST
DATA PROCESSING.

Progress Is Our Most Important Product

GENERAL ELECTRIC

LIGHT MILITARY
ELECTRONIC EQUIPMENT
DEPARTMENT

FRENCH ROAD, UTICA, N. Y.

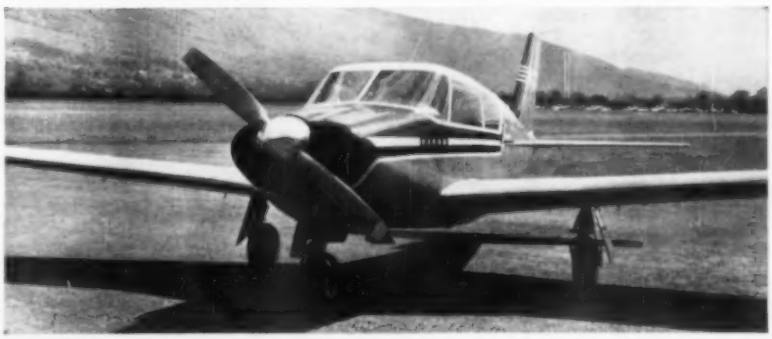
LAMINAR-FLOW WING was chosen to minimize drag. Wide cabin has rear seat wider than twin-engine Apache's standard 44-in. seat.

Piper Rolls Out Laminar-Flow Comanche

By Erwin J. Bulban

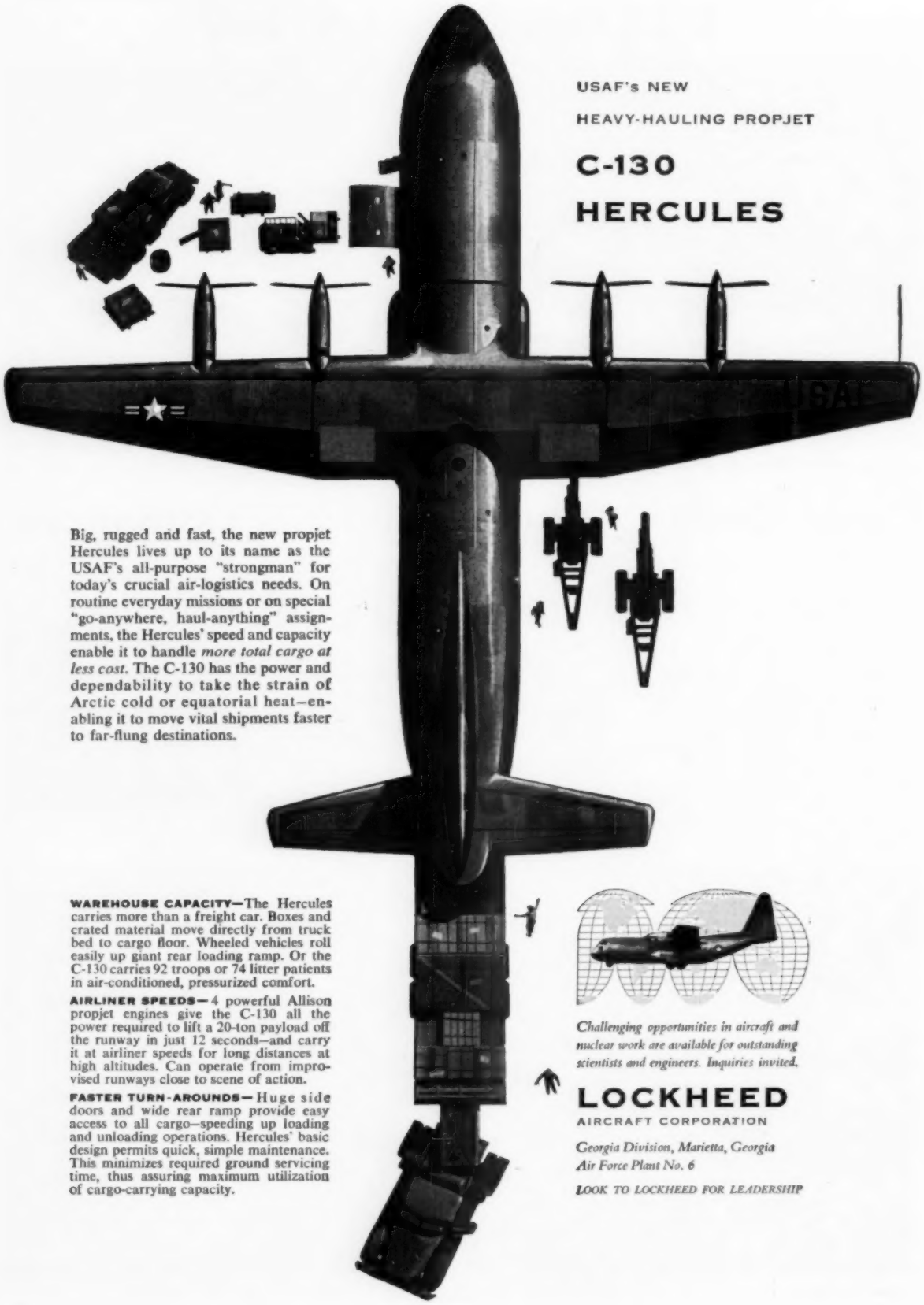
New York—Flight tests of Piper Aircraft Corp.'s new four-place all-metal low-wing PA-24 Comanche business plane have begun at Lock Haven, Pa. The PA-24 made its first flight May 23, piloted by Jay Myers.

Piper is withholding performance details until accurate data can be compiled. The Comanche is expected to cruise at about 160 mph. (AW Dec. 5, 1955, p. 52). The prototype is built from production tooling to speed the development-to-delivery cycle. A few Comanches are expected to be rolled



CLOSELY COWLED new 180-hp. Lycoming engine turns constant-speed Hartzell propeller.

SWEPT VERTICAL TAIL, one-piece horizontal surface are among features. Test pilot Jay Myers gets out of PA-24 after a flight.



USAF's NEW

HEAVY-HAULING PROPJET

C-130 HERCULES

Big, rugged and fast, the new propjet Hercules lives up to its name as the USAF's all-purpose "strongman" for today's crucial air-logistics needs. On routine everyday missions or on special "go-anywhere, haul-anything" assignments, the Hercules' speed and capacity enable it to handle *more total cargo at less cost*. The C-130 has the power and dependability to take the strain of Arctic cold or equatorial heat—enabling it to move vital shipments faster to far-flung destinations.

WAREHOUSE CAPACITY—The Hercules carries more than a freight car. Boxes and crated material move directly from truck bed to cargo floor. Wheeled vehicles roll easily up giant rear loading ramp. Or the C-130 carries 92 troops or 74 litter patients in air-conditioned, pressurized comfort.

AIRLINER SPEEDS—4 powerful Allison propjet engines give the C-130 all the power required to lift a 20-ton payload off the runway in just 12 seconds—and carry it at airliner speeds for long distances at high altitudes. Can operate from improvised runways close to scene of action.

FASTER TURN-AROUNDS—Huge side doors and wide rear ramp provide easy access to all cargo—speeding up loading and unloading operations. Hercules' basic design permits quick, simple maintenance. This minimizes required ground servicing time, thus assuring maximum utilization of cargo-carrying capacity.

Challenging opportunities in aircraft and nuclear work are available for outstanding scientists and engineers. Inquiries invited.

LOCKHEED

AIRCRAFT CORPORATION

Georgia Division, Marietta, Georgia
Air Force Plant No. 6

LOOK TO LOCKHEED FOR LEADERSHIP

RETRACTABLE TRICYCLE GEAR is mechanically operated, uses no hydraulics. Three wheels are reported to fold up very quickly.

out late this year and large-scale production is planned for spring of 1957.

The manufacturer is not talking prices. However, the new plane is expected to be competitive with the Cessna 180, which sells for approximately $14,000-$15,000. It will sell for less than the basic Beech Bonanza, which costs about $21,990.

Prototype Comanche is powered by a new engine, a Lycoming O360 developing 180-hp. for takeoff and continuous rating at 2,700 rpm.; 135 hp. at 2,400 rpm., using 91/96 octane fuel. Compression ratio is 8.5:1. The O360, certificated by Civil Aeronautics Administration, is a development of Lycoming's O320, the major basic change being larger cylinders. Propeller is a constant-speed Hartzell.

Sources close to Piper say the manufacturer has not decided flatly that the new O360 will be the powerplant for production Comanches. Piper has standardized the rest of its models (Super Cub, Tri-Pacer and Apache twin) on the 150-hp. O320 and is still weighing the pros and cons of introducing an additional engine to its line. It appears certain that the final choice will be a Lycoming product.

Another feature of the new plane is a high-aspect ratio wing using an NACA-developed laminar-flow airfoil. Only other postwar business plane having such an airfoil has been Mooney Aircraft's Mk. 20 four-placer. The Comanche also has a one-piece all-movable slab horizontal tail. The tricycle landing gear appears to have all three wheels the same size to ease spares problems and the landing gear is mechanically retractable to minimize maintenance.

Front seat is two in. wider than the Beech Bonanza and the rear seat is wider than the twin-engine Apache, a Piper spokesman said. The prototype airplane is equipped virtually like a demonstrator. Its instrument panel is almost identical to the Apache's.

Beech Gear Eases Crosswind Landings

New York—A safety landing gear designed to virtually eliminate crosswind problems and additional wing fuel tanks are among the improvements being offered as optional equipment to customers for the twin-engine Beech Super 18.

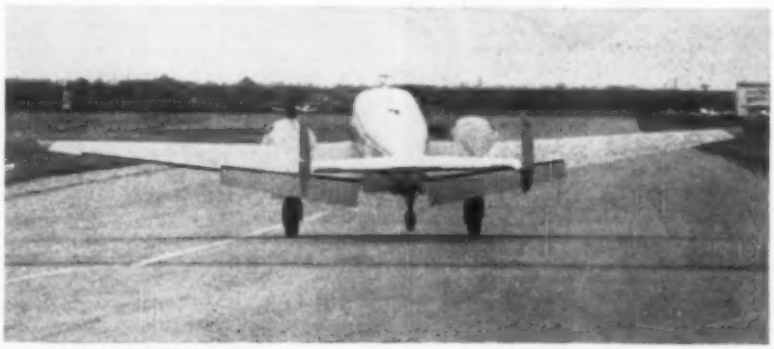
Both can be installed on the Wichita, Kan., production line. The landing gear also will be available in kit form for converting earlier Super 18s and Model D18s in the field, except those D18s having oleo lift legs. Price of the 17-lb. landing gear installed at the factory will be $1,500. The additional wing tanks will be factory-installed only because they require engineering changes and strengthening of the outer panels. Their cost installed: $2,000 plus trade-in of a nose tank.

Only the downwind wheel of the landing gear casters. After the sideloads on this wheel are relieved as the airplane swings to a heading parallel to its flight path, the wheel returns to normal alignment. The landing gear acts normally during taxiing or when the airplane is being towed or pushed.

This normal behavior differs from full-castering crosswind landing gears, which provide the sensation of moving at an angle while taxiing and which reportedly have complicated moving an airplane in a hangar should the wheels caster.

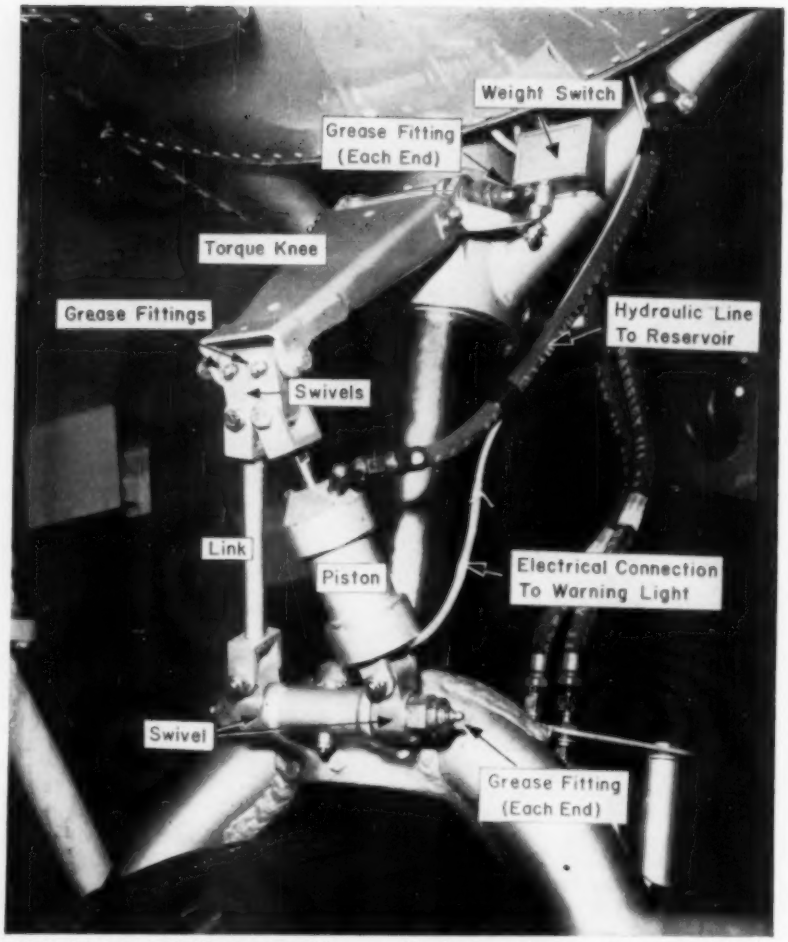
The system is an integral part of the landing gear and consists of a hydraulic cylinder and piston replacing one leg of the torque knee. A rod fitted with swivel connections replaces the other leg. The torque knee is mounted on the airplane structure and incorporates a spring-loaded piston (see photo, right).

When the main wheels contact the runway at an angle to the flight path, as in a crosswind landing, the side loads applied to the downwind wheel cause



DOWNWIND WHEEL (right) will caster due to side loads, bring plane to normal heading.

Gladden
PRODUCTS CORPORATION
635 W. Colorado Blvd., Glendale 4, Calif.
The Emblem of Advanced Aircraft Engineering and Proven Performance
Manufacturers of Hydraulic, Pneumatic, and Electronic Equipment



HYDRAULIC AND SPRING CONTROL are used in Geisse landing gear for castering wheels.

it to caster outward, compressing the fluid in the torque-knee cylinder. This in turn pressurizes the upper cylinder, compressing the spring which bears against its piston. With the wheel castered, the plane swings to a heading normal to its flight path, relieving the loads on the castered wheel. The upwind wheel slides and assists in straightening the airplane.

Gear Developer

Each lower cylinder has a weight switch which activates a signal light on the instrument panel whenever either piston leaves the bottom of its cylinder, notifying the pilot that the wheel is castered and that the landing gear should not be retracted.

The castering gear system was developed by John H. Geisse, formerly consultant on crosswind landing gears for the Bureau of Air Commerce, Department of Commerce and Civil Aeronautics Administration. The Geisse safety gear is CAA-approved for the Super 18.

The revised Super 18 pilot handbook instructs the pilot that he must make his track over the ground in final approach directly in line with the runway or desired landing roll direction if he is to realize full benefits of the system. Best results are obtained in three-point landings.

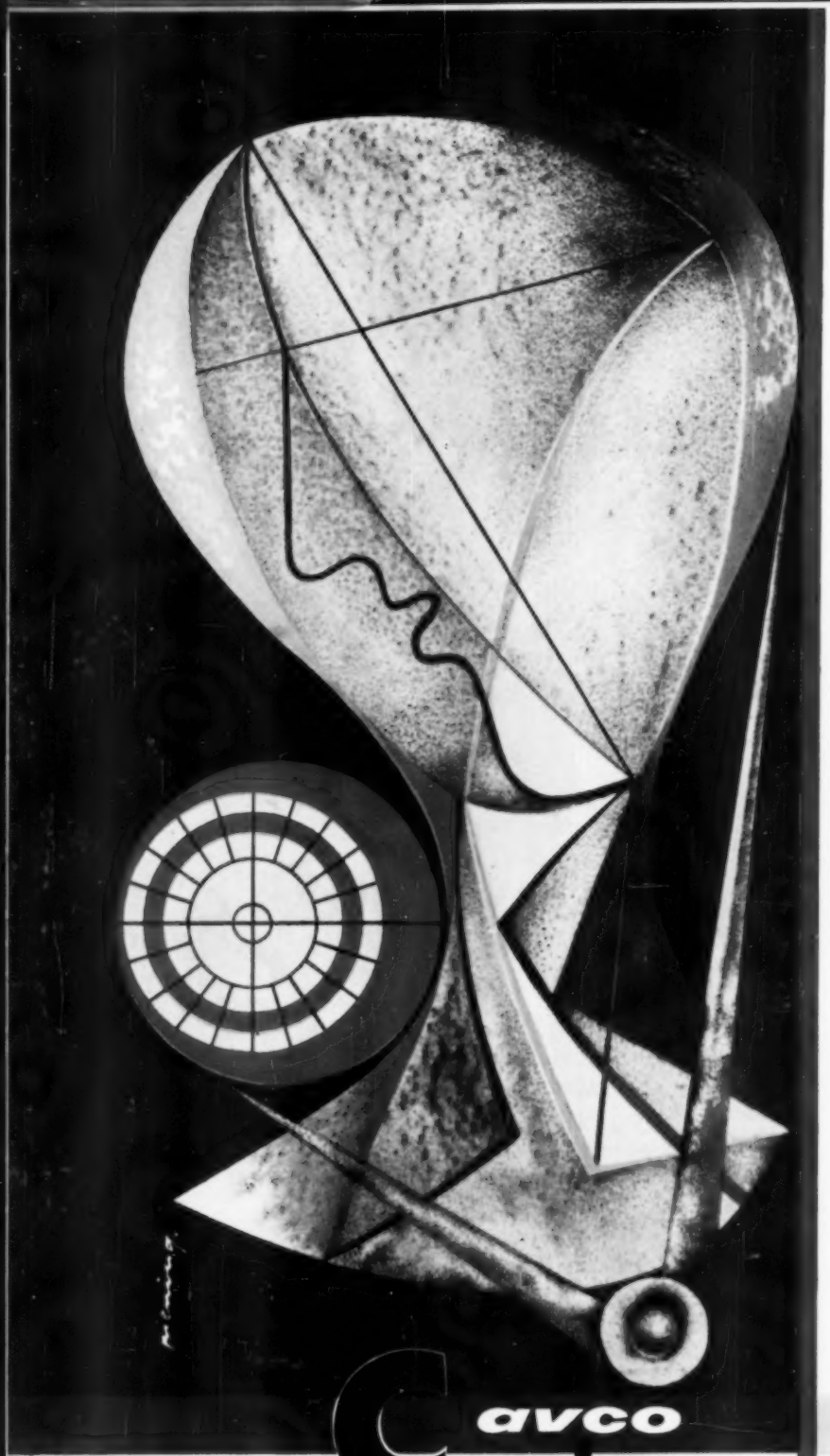
Once the plane is headed straight down the runway, the same crosswind technique used with conventional landing gear is utilized. If it is impossible to keep the airplane from weathercocking, starting a turn into the wind, the downwind wheel will caster again to prevent an uncontrollable ground loop.

"We figure that if this system is instrumental in preventing one bad groundloop, it has paid for itself," a Beech spokesman told AVIATION WEEK.

Straightens Airplane

The safety gear has no effect on a normal crosswind takeoff, except if a high-rate turn or groundloop should develop, it will go into action to straighten the airplane on a new heading and assist in bringing it under control.

On crosswind takeoffs, Beech's Super 18 manual says it is helpful to apply



avco
Crosley

Avco Crosley measures man for tomorrow's machines

There is only one component in a modern machine system which engineers cannot "improve." That is the all-important, "human component"—man, himself.

To adapt changing machines to unchanging human capacities, Experimental Psychologists of Avco's Crosley division are taking a closer look at man—his mind, his body, his reactions. From these patient investigations are emerging ways to make present and future machines simpler, more obedient, more valuable to man.

By measuring man *today*, Avco Crosley "human engineering" helps assure man that he will realize the *full* benefits of the machines he builds *tomorrow*.

To find out how "human engineering" might improve your present or future products—phone, wire, or write to: Avco Defense and Industrial Products, Stratford, Conn.

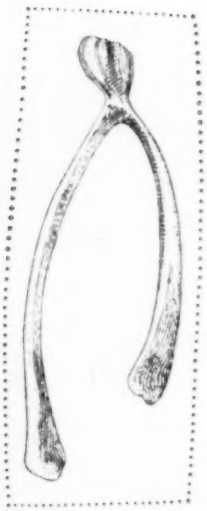
Engineers Wanted: For top-flight men, Crosley offers unusual opportunities to explore new scientific frontiers. Write to Director of Engineering, Crosley Government Products, Cincinnati 15, Ohio

TODAY'S MILITARY SERVICES, WITH THEIR TREMENDOUS TECHNOLOGICAL ADVANCES MADE POSSIBLE THROUGH SCIENCE, OFFER A VITAL, REWARDING CAREER.

defense and industrial products

Avco Defense and Industrial Products combine the scientific and engineering skills, and production facilities of three great divisions of Avco Manufacturing Corp.: Crosley; Lycoming; Research and Advanced Development—to produce power plants, electronics, airframe components, and precision parts.

FOR A COPY OF THIS PIENING ILLUSTRATION, SUITABLE FOR FRAMING, WRITE TO PUBLIC RELATIONS DEPT., AVCO DEFENSE AND INDUSTRIAL PRODUCTS, STRATFORD, CONN.



wish you were here!

The USAF Inter Continental Ballistics Missiles are being developed in the heart of the Rocky Mountain Empire by the foremost scientists and engineers in America, the research team of The Glenn L. Martin Co., Denver Div.

. . . and you are invited to become a part of this team that has produced so many other Martin "firsts" in research engineering and development of weapon systems.

The job is a challenging one. Furthermore, it is permanent. And Martin is providing the finest engineering, laboratory and production facilities available. Salary levels, of course, are commensurate with experience and ability.

But the really wonderful advantage that engineers have at Martin's Denver Division is that of rapidly advancing oneself professionally while enjoying one of the most beautiful and stimulating environments in the world . . . Colorful Colorado.

Here's what you'll find: Brilliant sunshine over 300 days each year; unlimited recreational facilities in winter as well as summer; healthy, mountain air that's crisp, fresh and exhilarating; cool summers, mild winters, modern schools and shopping centers, and relaxed living for every member of the family.

Martin is developing another "first" in Denver. So why not take your vacation in Colorado, and while you're enjoying the beauty of the Rockies, take time to stop in and talk to the people at Martin. It might be a turning point in your life and you'll wish you were here too . . . PERMANENTLY.

Martin extends this invitation to Aeronautical, Mechanical, Electrical, and Structural Engineers and Technicians and to Mathematicians and Physicists. If you have already made other vacation plans however...

Write to:
Emmett E. Hearn, Employment Dir., Dept. K-2, P.O. Box 179, Denver 1, Colo.

MARTIN
DENVER DIVISION

NORMAL alignment (above) and castered outward position (below) of left wheel.

power to the upwind engine a little in advance of the downwind engine and to carry a little more power on the upwind engine during the first part of the takeoff roll. As soon as the rudders become effective, takeoff power should be applied to both engines. At about 60 mph. indicated airspeed the tail is raised and the airplane is flown off. Since the plane will tend to weathercock as soon as it leaves the ground, it is important to resist pulling it off until there is no possibility that it can settle back onto the runway.

Fuel Increase

Installation of the outboard fuel tanks to replace the standard nose auxiliary tank increases the Super 18 fuel capacity 43 gal., to 318 gal. Each of the new wing tanks carries 62.5 gal. Additional weight of the wing tanks is about 50 lb.

In addition to increasing endurance, relocation of the fuel enables placing all radio equipment in the nose and makes possible installation of weather radar. Moving the ADF from the baggage compartment to the nose increases space in that area and allows more flexibility in load distribution.

Besides these optional equipment items, Beech is making standard on the Super 18:

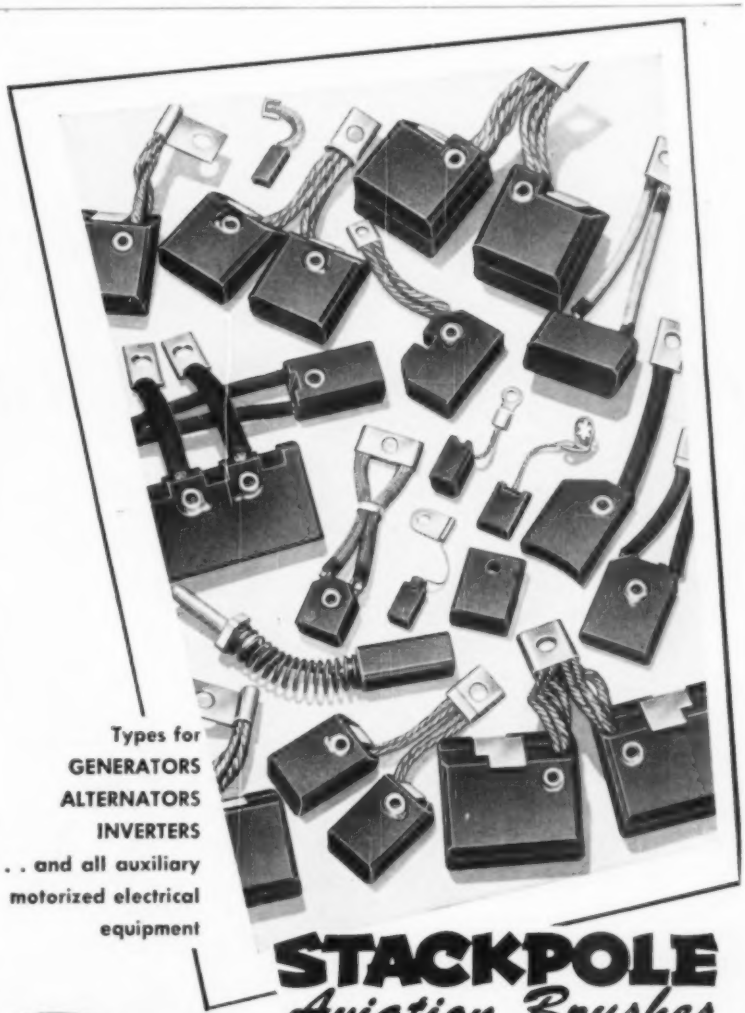
• **Landing lights** of 1,000 watts in the leading edges of the wings, and 400-watt taxi lights incorporated in the landing lights on a separate filament and operated by separate switches. The new arrangement is aimed at eliminating buffeting previously experienced using the former retractable landing lights, and it eliminates the need for separate taxi lights in the nose.

• **All-metal wing flaps** to replace the former fabric-covered flaps, reducing maintenance and damage previously caused by landing in mud, slush and water. The new flaps weigh about 3 lb. less than the fabric-covered ones.

• **Goodyear nylon** tubeless tires, added to save weight and lower operational costs.

PRIVATE LINES

Dornier Works, Friedrichshafen, Germany, plans to market its five-place all-metal short-field Do. 27 in the U. S. after flight tests are completed. Powered by a 270-hp. Lycoming, the Do. 27 has a 1,290-lb. payload and top speed of 160 mph. Takeoff run is reported as



Types for
GENERATORS
ALTERNATORS
INVERTERS
. . . and all auxiliary motorized electrical equipment

STACKPOLE
Aviation Brushes

THIS IS OUR 50th Year
STACKPOLE
FOUNDED 1906

. . . each unit backed by half a century's experience in developing, producing and applying carbon, graphite and metal graphite materials

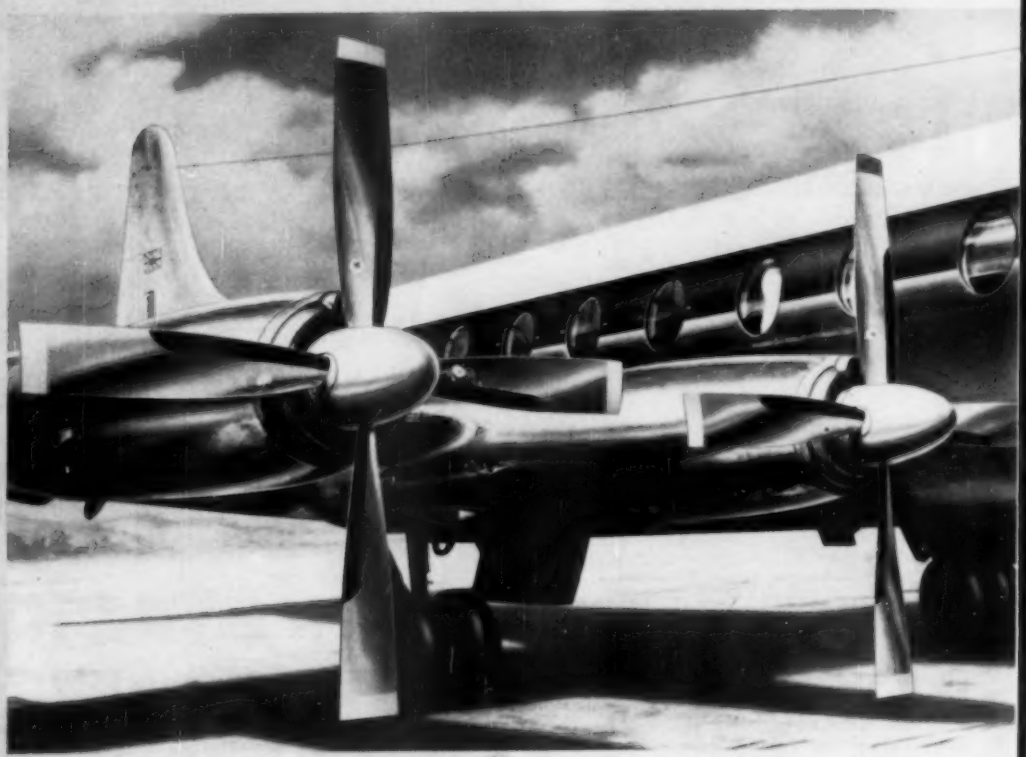
STACKPOLE CARBON COMPANY, *St. Marys, Pa.*

ROTOL *Propellers*

. . . are fitted to over 100 Vickers Viscounts in airline operation.

. . . have been specified for over 200 more Viscounts now on order.

. . . on the Viscounts have completed nearly a million flying hours.



ROTOL LIMITED · GLOUCESTER · ENGLAND

377 ft.; landing run at 328 ft. Continental engine is optional in place of the Lycoming. Dornier has authorized representation in New York.

A curriculum for corporation pilot training will be evaluated by a special committee of business pilots working with the Flight Safety Foundation, New York City. Purpose is to provide pilots with a program they could follow at one of several privately operated schools providing such facilities in U. S.

Study in contradiction: An official in the office of the U. S. Weather Bureau recently urged pilots follow-up on the agency's requests for data on altitude of cloud tops, turbulence, unusual winds, icing and other conditions encountered en route. But at a recent meeting of the International Air Transport Assn. at San Remo, Italy, discontinuance of these reports was asked on the grounds they clutter up already overburdened air communications.

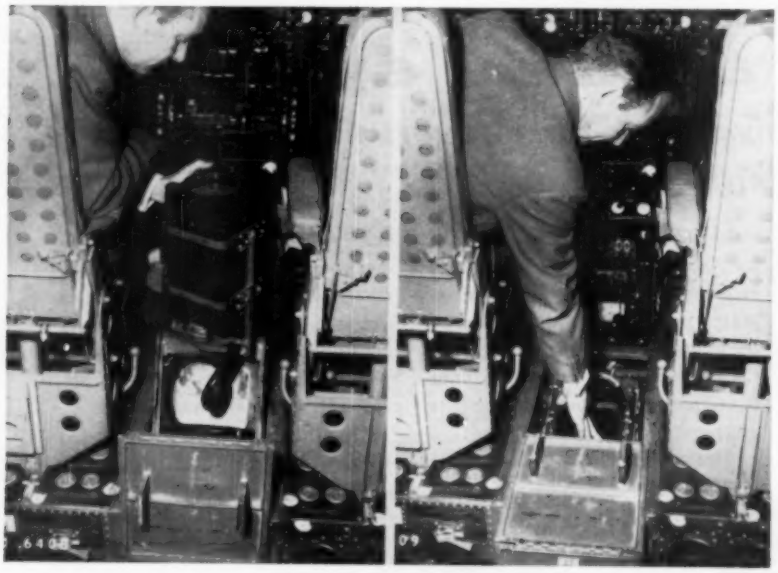
Cessna 310 engineers are studying ways of increasing the twin-engine Model 310 range by adding to present 100-gal. fuel capacity, carried in wingtip tanks.

Over $400,000 in orders for 30 fibrous-glass covered Ranch Wagon and Topper business planes have been placed with Taylorcraft, Inc., by two distributors. One plane will be fitted with radioactivity detection gear for aerial prospecting in Canadian Northwest.

DEMONSTRATION of Bell 47G helicopter's ability to rid hundreds of miles of clogged Florida drainage ditches and navigable waterways of hyacinths by spraying them with herbicide is expected to lead to a $376,000 annual contract from that state. Initial bidders are two Jacksonville businessmen who expect delivery of one 47G immediately and two more later. A sideline will be spraying of mosquito breeding grounds.

First Bellanca-designed Cruisemaster being built by Northern Aircraft, Alexandria, Minn., will fly late this summer.

Effective Aug. 1, 1956 pilots flying Instrument Flight Rules are required to have an artificial horizon and directional gyro or equivalent under CAB amendment to Civil Air Regulation 43.30.



A Tip on Mounting Radar Scopes

A possible solution to the problem of installing weather radar scopes in business plane cockpits is this retractable mount used by TWA in its Super Connies. Unit is located behind the control pedestal between the seats. Business pilots were shown slides of this installation at recent Flight Safety Foundation forum in N. Y. (AW June 4, p. 96).

Ah there, MOEBIUS!

One-sidedness is an amusing curiosity in topology. But in career-building, the talented engineer has to think three-dimensionally, and focus his time and energy where they'll be the most rewarding.

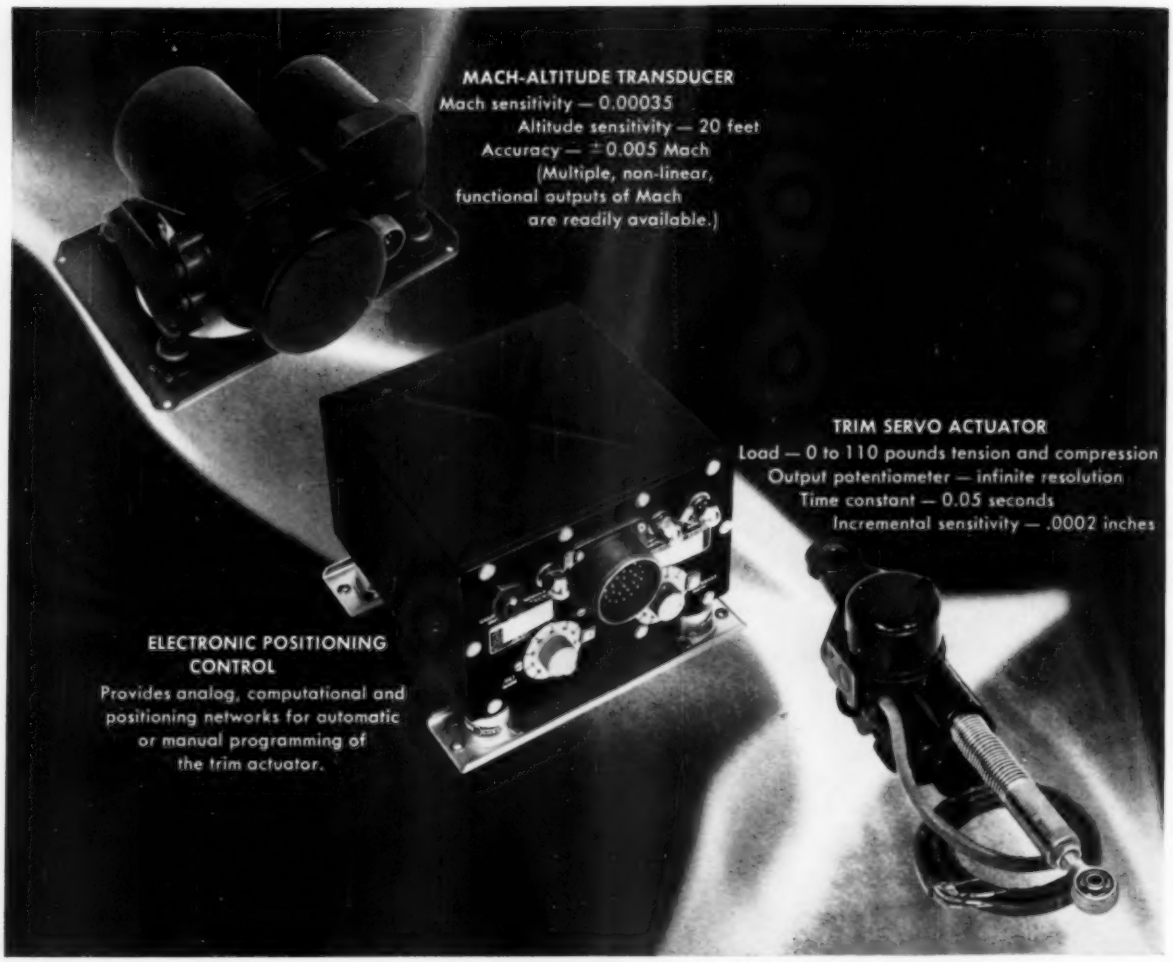
Here at All American we deal in all sorts of ideas. We haven't found a use yet for Mr. Moebius's, but have made and are making much progress in a large variety of other stimulating projects. Such as, tow-target and air-sea rescue winches, in-flight refuelling systems, ejection seat trainers, arresting gear and other problems of energy absorption . . . a variegated and challenging list for *Aeronautical and Mechanical Engineers*. Drop us a line right now. Your confidence will be respected.

Write to Ray Janney, Chief Engineer

All American Engineering Company

DUPONT AIRPORT • WILMINGTON, DELAWARE

RESEARCH • DESIGN • MANUFACTURE


MACH-ALTITUDE TRANSDUCER
Mach sensitivity — 0.00035
Altitude sensitivity — 20 feet
Accuracy — ±0.005 Mach
(Multiple, non-linear, functional outputs of Mach are readily available.)
TRIM SERVO ACTUATOR
Load — 0 to 110 pounds tension and compression
Output potentiometer — infinite resolution
Time constant — 0.05 seconds
Incremental sensitivity — .0002 inches
ELECTRONIC POSITIONING CONTROL
Provides analog, computational and positioning networks for automatic or manual programming of the trim actuator.

Proved air data system

AiResearch solves stick-force reversal on latest high-speed aircraft

There's no secret to the development of a fine aircraft air data system. Required are superior components, compatible and reliable, that produce the desired stimulus-response pattern with minimum weight and size and maximum efficiency.

The simple elevator trim servo system illustrated is only one of many integrated systems produced by AiResearch to meet customer requirements. Thousands of AiResearch transducers and actuators of the highest sensitivity and performance are now in service. New ones to even more exacting requirements are constantly being developed.

A few of the fields in which we have extensive experience are temperature and flight controls, instrumentation, air data, ballistics computations and positioning and sensing systems. Let an AiResearch engineering team study your problem and formulate a solution.

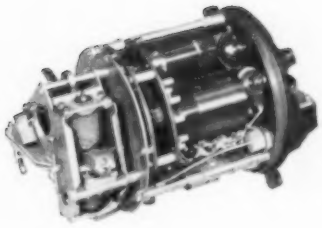
Qualified engineers are needed now. Write for information.

THE GARRETT CORPORATION

AiResearch Manufacturing Divisions

Los Angeles 45, California • Phoenix, Arizona

Designers and manufacturers of aircraft systems and components: REFRIGERATION SYSTEMS • PNEUMATIC VALVES AND CONTROLS • TEMPERATURE CONTROLS
CABIN AIR COMPRESSORS • TURBINE MOTORS • GAS TURBINE ENGINES • CABIN PRESSURE CONTROLS • HEAT TRANSFER EQUIPMENT • ELECTRO-MECHANICAL EQUIPMENT • ELECTRONIC COMPUTERS AND CONTROLS



This is the altitude control used in Honeywell's MB-3 flight control system. It will hold modern supersonic aircraft to within inches of a selected altitude for extended periods of time. Yet, despite its extreme sensitivity, it is only four inches in diameter and weighs only 3.6 pounds. Honeywell, through its ability to design and produce components like this, has made more aircraft flight control systems than any other company in the world.

AERONAUTICAL DIVISION, MINNEAPOLIS-HONEYWELL

Have you heard about the great new

GULF AIRCRAFT ENGINE OIL?

It's proved 5 ways better

Gulf laboratory and flight tests *proved* it.

And now—private operators and operators of executive fleets and airlines are confirming everything we say for this new high-quality oil.

Here's what new Gulf Aircraft Engine Oil does for your engine:

1. Improves internal engine cleanliness.
2. Minimizes sludge and oil inlet screen deposits.
3. Lowers rate of parts replacement due to wear.
4. Low pour-point for ease of starting even in coldest weather.
5. Increases periods between engine overhauls.

Try new Gulf Aircraft Engine Oil in *your* plane. Find out for yourself how these 5 advantages can give you *maximum operating efficiency* and *increased economy* through cleaner engines and less frequent overhauls!

GULF
AVIATION PRODUCTS

Gulf Oil Corporation
Gulf Refining Company

CAB Accident Investigation Report

Icing Blamed in Crash of Lodestar

A Lockheed 18-56 Lodestar, N 33366, owned and operated by the Gulf Oil Corporation, crashed about 4½ miles northwest of Londonderry, Ohio, at approximately 1240,[1] Dec. 29, 1955. After impact the wreckage was partially burned by ground fire. The pilot and copilot, the sole occupants, were killed.

Pilot Gordon Whewell Silva and Copilot-Flight Mechanic Lloyd Littleton Cotton, on Dec. 28, prepared N 33366 (hereinafter referred to as N 366) for a nonstop flight from Tulsa, Okla., to Pittsburgh, Pa.

After a study of the weather data Pilot Silva filed an IFR (Instrument Flight Rules) flight plan which called for a proposed departure at 0800 CST for Pittsburgh via Victor Airways 14, 72, and 12, with an estimated elapsed time of four hours. It also showed fuel for 6:15 hours, an en-route altitude of 9,000 feet, destination Pittsburgh, and alternate Wheeling, W. Va. The flight departed Tulsa at 1810 CST and routine position reports were made until over Dayton, Ohio, at 1200.

Starting with the Dayton position report in which the first mention of icing conditions was made, all of the entries in CAA station logs recording communications with N 366 are transcribed as follows:

"N 366 over Dayton 1200E 9,000 feet estimate over Columbus 1218E Adamsville. (Will make next report from Adamsville.) Request lower altitude light to moderate rime icing."

Request Refused

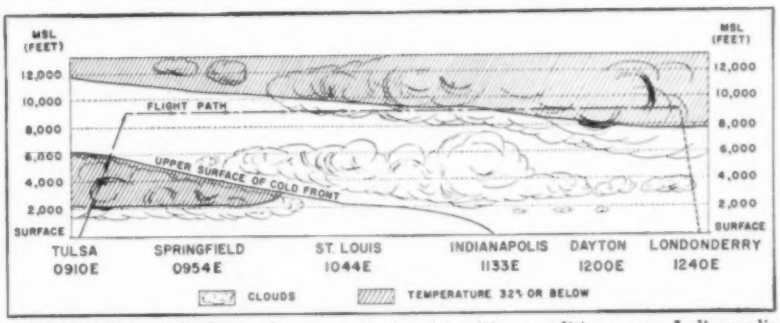
This message was delivered at 1203 to the Indianapolis center who replied, "ATC advises unable approve lower altitude." This reply was delivered to N 366 at 1204.

At 1221 CAA Columbus recorded the following from N 366, "Over Columbus 1220, 9,000 msl. estimate over Adamsville 33 HLG (will make next report via Wheeling). Destination Pittsburgh requesting 5,000 feet msl." At 1224 the following was transmitted to N 366 by Columbus, "ATC unable to approve 5,000 feet msl. or 7,000 feet msl."

At 1227 Columbus received from N 366, "Rime ice request lower altitude as soon as possible." And at 1234, N 366 advised Columbus, "Over Adamsville 1233 9,000 feet msl. Adena 47." The pilot was questioned about the Adena estimate and changed it to "Wheeling" (as next reporting point). Also in this communication he reported, "Difficulty maintaining altitude and airspeed request lower altitude." At 1237 Columbus CAA transmitted, "Clearance to descend and maintain 8,000 msl." and the pilot replied, "Leaving 9,000 msl. at 1237E."

All further attempts to communicate with N 366 were unsuccessful. At approximately 1240 witnesses observed the aircraft below the overcast; it was on a westerly heading and was descending although it appeared to be in a normal attitude. Several componests were seen to separate from the aircraft before it struck the ground.

[1]All times herein are based on the 24-hour clock and are Eastern Standard unless otherwise stated.



FLIGHT PATH of Lodestar shows penetration into icing conditions near Indianapolis.

INVESTIGATION

The flight was for the purpose of ferrying N 366 from its base at Tulsa to company headquarters at Pittsburgh. On December 28, Pilot Silva had received notification from his company to make a passenger flight out of Pittsburgh on December 30. Pilot Silva, with Copilot Cotton, planned to fly nonstop to Pittsburgh on December 29.

Area forecasts applicable to this flight were issued at 0622 CST and were valid for the period 0700 to 1900 CST. These indicated a cold front at the beginning of the period along a line from extreme northwest Indiana to Rantoul-St. Louis-Joplin, thence between Tulsa and Ft. Smith. This front was expected to move southeastward during the period at about 20 knots in the north portion to about 12 knots in the south portion.

Behind (northwest of) this front the overcast was expected to have a ceiling of 800 to 1,200 feet and tops 6,000 to 8,000 feet msl. Light icing was forecast in the clouds in the freezing levels and the base of the freezing level was expected to lower in the cold air to between 2,000 feet and the surface.

Ahead of the front the ceiling was expected to range from 2,000 to 5,000 feet. Tops of the highest cloud layers were expected to range from 10,000 feet to 12,000 feet msl. in Missouri and Southern Illinois and as high as 18,000 feet in Indiana and southern Ohio.

The freezing level was forecast to be from 10,000 to 12,000 feet msl. with light icing in the clouds above that level in Missouri and southern Illinois and light to moderate in southern and central Indiana and in southern Ohio.

Pilot Silva visited the Weather Bureau at Tulsa on Dec. 28, at which time he received a weather briefing for his proposed flight on the following day. He again visited the Weather Bureau on the morning of Dec. 29 and the meteorologist on duty stated that he spent some time reviewing briefing material on display.

This included current reports, upper air, and forecasts pertinent to his flight.

His only request for advice from the meteorologist was in regard to the height of the top of the overcast in the Tulsa area. Silva did not request any weather advice while en route, either from the Weather Bureau or concerning reports from other pilots even after he was encountering ice. The forecast read by him before departure indicated icing above 10,000 feet in eastern Indiana and in Ohio, whereas pilot reports made while he was en route indicated icing in southern Ohio to as low as 8,000 feet.

Weather Observations

Weather observations made nearest the time and place of the accident were: Wheeling (34 miles ESE of scene) 1230-ceiling estimated 5,000 feet, overcast; visibility 6 miles, temperature 43, dewpoint 31; 1330—ceiling estimated 5,000 feet, overcast; visibility 6 miles, smoke; temperature 43, dewpoint 32. Zanesville (35 miles SW of scene) 1230—ceiling estimated 3,000 feet broken, 5,000 feet overcast; visibility 7 miles, temperature 43, dewpoint 31; 1330—ceiling estimated 5,000 feet, overcast; visibility 6 miles, very light rain showers, temperature 44, dewpoint 38. The area about the scene of the accident was free from snow, and no ice due to precipitation was present.

In the immediate vicinity in which the separated components of the aircraft were found (these components were identified as members of the tail group) there were many ice chunks shaped as those that build up on the surfaces of aircraft in flight and of the size expected if they had broken from those surfaces. Before these pieces of ice were noticed the elapsed time and temperature could have reduced their size,

PUBLISHING DATE

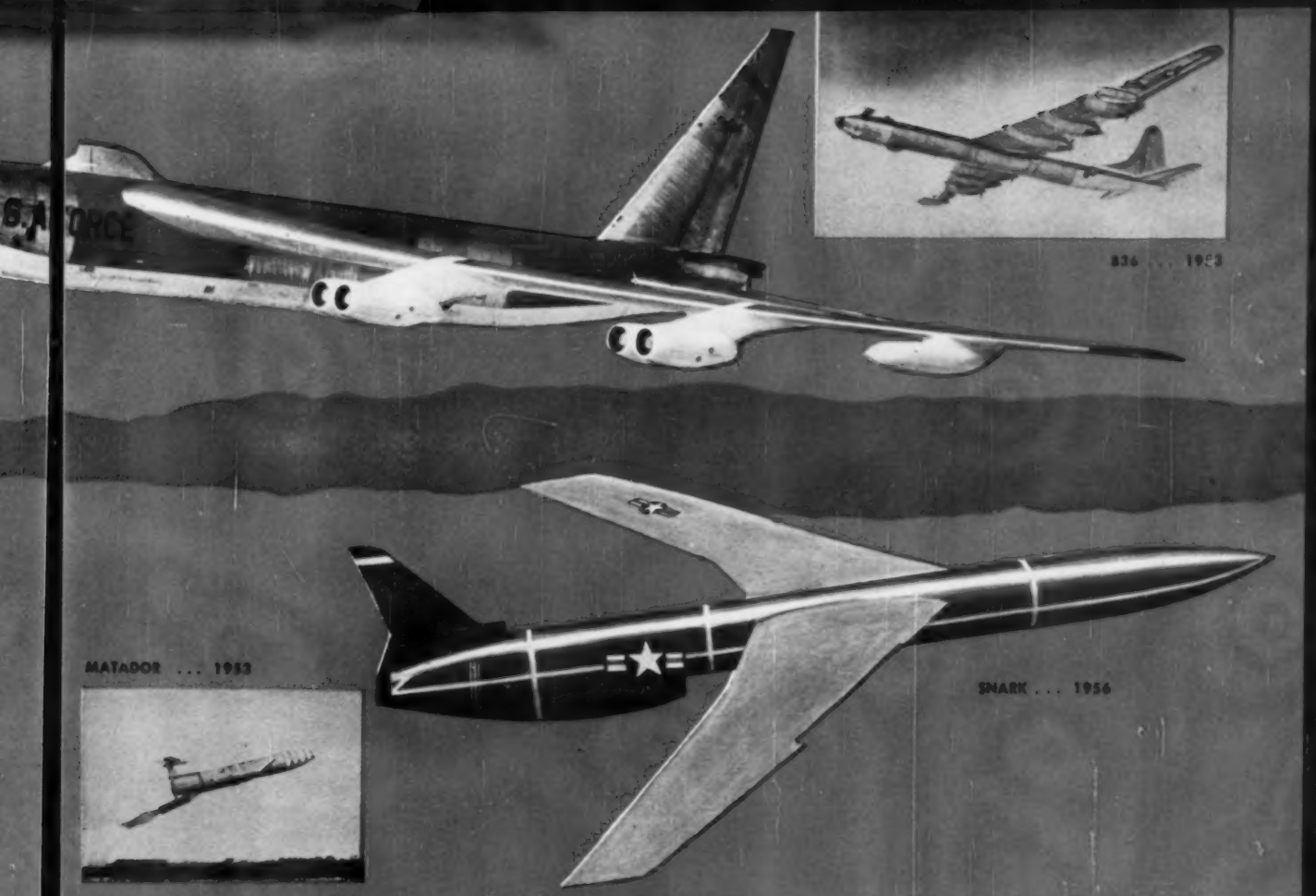
August 6, 1956

THE ONE AIR RESEARCH and

TIMED TO FEATURE

- **AIR RESEARCH AND DEVELOPMENT PROGRAM** as determined by the 1957 fiscal Air-power budget now in debate and to become effective **July 1, 1956.**
- **SPECIAL COVERAGE** of the latest critical areas of research—astronautics, super aero-dynamics and human factors.
- **UP-TO-THE-MINUTE RESEARCH DEVELOPMENTS** in avionics, aeronautical engineering and missile engineering.
- **ON-THE-SPOT REPORTING** at all the 12 research and development testing centers of AIR RESEARCH AND DEVELOPMENT COMMAND of the United States Air Force by AVIATION WEEK's technical editors — the largest technical staff in Aviation publishing.

ONLY ONE ARDC EDITION in 1956 will satisfy aviation's "need to know", with a presentation of the ARDC story.



EXCERPT FROM HEADQUARTERS ARDC LETTER TO AVIATION WEEK

"There have been so many changes, improvements and advances that another special ARDC issue appears very timely and promises to be of the same if not greater benefit and interest than the 1953 edition."

DEVELOPMENT COMMAND EDITION

. . . over **80,000*** Engineering-management men will read and refer to this vital edition and several thousand copies will be made available for special service uses.

Your advertising message placed in the ARDC issue will reach Aviation's most influential audience.

* AVIATION WEEK average net paid ABC circulation June-December, 1955; 54,548. Paid circulation of current issues; 59,859. Recent readership research by Advertising Research Foundation shows 1.4 readers for every subscriber copy of AVIATION WEEK (readership determined by personal interview using strict recognition test. Current print order 64,293 copies.

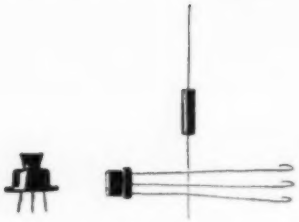
Get immediate attention for your ARDC EDITION advertising needs, by contacting YOUR AVIATION WEEK REPRESENTATIVE.

District Offices: **New York 36,** 330 W. 42nd Street; **Philadelphia 3,** Architects Bldg., 17th & Sansom Sts.; **Cleveland 15,** 1510 Hanna Bldg.; **Chicago 11,** 520 N. Michigan Ave.; **Dallas 2,** Adolphus Tower Bldg., Main & Akard Sts.; **San Francisco 4,** 68 Post St.; **Los Angeles 17,** 1125 W. Sixth St.; **Atlanta 3,** 801 Rhodes-Haverty Bldg.; **Detroit 26,** 856 Penobscot Bldg.; **Boston 16,** 350 Park Square Bldg.; **London EC 4,** 95 Farringdon St.; Paris 8, 5 Ave. George V.

AVIATION WEEK

A McGRAW-HILL PUBLICATION

World premiere—starring Transistors



The Department of the Navy, Bureau of Ships, receives the world's first completely transistorized dial telephone switchboard . . . designed for minimum space, weight and maintenance.

In this compact switchboard cabinet (72″ x 30″ x 24″) all line finding, circuit switching, tone signal generating, and in fact, virtually all functions of conventional dial telephone switching are performed by transistors and diodes.

Capacity of this prototype electronic switchboard is 100 lines, with fifteen connecting links. The officers and men use their telephones just as if the switching system were the conventional type. And when the ship on which this telephone system is installed docks in port, ship-to-shore trunk connections are added as easily as an extension telephone in your home.

And for those interested in production details, it's noteworthy that this compact, lightweight system is manufactured with plug-in printed circuits—providing shockproof, lifetime accuracy.

We take great pride in being a team partner with the Navy in this outstanding technological development.

STROMBERG-CARLSON COMPANY

A DIVISION OF GENERAL DYNAMICS CORPORATION

General Offices at ROCHESTER 3, N. Y.

S-C

which still was reported by witnesses to have been up to 8 in. in length and up to 2 in. in thickness. As reported by the witnesses this ice was hard and milky in appearance and it was found only near the tail parts or between those parts and the main wreckage.

No Wing Deicers

The aircraft was equipped for deicing of carburetor, windshield, and propeller blades with alcohol. There was no deicer equipment on the wings or tail surfaces. Chief Pilot Bruce Grove stated that it was found to be impracticable to maintain such equipment in working order because of cuts made by stones when operating from some of the airports used by company aircraft. Grove also stated that in the operations of its aircraft the company policy is to avoid icing conditions as much as possible.

Statements in writing were taken from eight of the witnesses interviewed. All of them heard the engines of the aircraft and the sound of the ground impact. Five witnesses saw the airplane in flight; two saw parts separate from the airplane. However, none of them saw fire or smoke from the airplane before impact with the ground.

The last known course flown by N 366 was eastbound along V-12, which route is 84 deg. magnetic. In striking the ground the aircraft cut a swath through trees on a heading of 252 deg. magnetic and at a steep angle. The vertical surfaces of the tail group were recovered from a point 1 to 1¼ mi. eastward (70 deg. magnetic) of the main wreckage.

All of these parts were fragments of the vertical surfaces (fins, rudders, and tabs) above the horizontal stabilizer. Except for these parts, all components of the aircraft were found within 160 ft. of the center of the wreckage area. Some parts of the separated tail components had been carried away by souvenir hunters. At the request of investigators these parts were returned and all components of the aircraft were then in hand except the right vertical fin.

The manner in which the propeller blades were bent and broken from the hubs indicated that power was being developed by both engines at the time of impact.

Investigators found traces of smoke and fire on only those portions of the wreckage that had been exposed to ground fire.

So much of the wreckage was completely demolished by impact and fire that the most significant items of information gained from its examination were the attitude of the aircraft at time of impact, the direction of its movement, the presence of ice, and the separate location of the detached components.

ANALYSIS

Two high pressure areas existed during the early morning of Dec. 29, 1955. One was located in the Northern Plains states, the other along the Atlantic Seaboard. Between these two highs a trough of relatively low pressure with a cold front extended southwestward from eastern Lake Superior through Wisconsin, Illinois, Missouri, and Oklahoma.

This cold front was moving southeastward and had passed Tulsa, Springfield, Mo., and St. Louis previous to departure of the flight from Tulsa. The front reached Indianapolis about the same time

NORTH AMERICAN'S
Columbus Division

Provides OHIO Opportunities For Experienced ENGINEERS

In Columbus, thousands of professional people have found a city that satisfies an educated way of life. Columbus offers fine centers of learning and cultural opportunities.

At North American's Columbus Division, many of these people work on the completely sufficient, young but proved engineering team dedicated to one of aviation's greatest challenges—the design, development and manufacture of North American's Naval airplanes.

The highly regarded FJ-4 FURY JET is a "concept-to-flight" Columbus Division product, and stability from association with North American Aviation, the company that has built more airplanes than any other in the world . . . compose a career opportunity worth investigation by any engineer:

A SELECT FEW POSITIONS ARE OPEN IN EACH OF THESE FIELDS:

Aerodynamicists, Thermodynamicists, Dynamicists, Stress Engineers, Structural Test Engineers, Flight Test Engineers, Mechanical and Structural Designers, Electrical and Electronic Engineers, Wind Tunnel Model Designers and Builders, Power Plant Engineers, Research and Development Engineers, Weights Engineers.

For the Full Story On Your Ohio Future, Write Today: Mr. J. H. Papin, Personnel Manager, Department 56M, North American's Columbus Division, Columbus 16, Ohio.

Engineering Ahead for a Better Tomorrow

NORTH AMERICAN AVIATION, INC.

COLUMBUS DIVISION

F-86 Saberjets and H-13 helicopter of the 15th Fighter Group, Niagara Falls, N. Y.

A MATTER OF *Minutes...*

Only minutes for U. S. Air Force interceptors to get in the air and on target . . . and minutes, too, for a Bell H-13 helicopter to be at the scene of a possible emergency.

In defense, as in rescue, time can be all-important. And Air Defense Command pilots in fast-moving jets or ever-alert helicopters fully realize that minutes *can be the difference* between the success or failure of a mission.

When an unidentifiable blip appears on the radar screen, the nation depends on its interceptor pilots to run a check miles high in the sky. And pilots who may have to ditch in the water or make a forced landing, depend on helicopters to find them and get them back to base.

The pattern for such current operations was set in Korea where helicopters like the Bell H-13 rescued more than 25,000 wounded troops and hundreds of pilots, many of whom were forced down behind enemy lines. The maneuverability, flexibility and reliability of the helicopter is an important adjunct to the Air Force in this supersonic age.

BELL
Aircraft CORPORATION

Ft. Worth, Texas • Buffalo 5, N. Y.

Young Men! Your Future Begins Now...
in the U. S. AIR FORCE

the flight passed over that area. The cold air behind the front had deepened from the surface to about 6,000 ft msl. at Tulsa at takeoff time.

Clouds and below freezing temperatures existed in that area from about 2,000 ft. to 6,000 ft.

The upper surface of the cold front was at 6,000 ft., above which clear air and above freezing temperatures existed upward to about 11,000 ft.

This latter condition existed along the route to the northeast at 9,000 ft. (cruising level) to near St. Louis where instrument conditions began.

Below freezing temperatures, with icing likely, began at or soon after passing Indianapolis. Thence to Londonderry variable icing was indicated at 9,000 ft., ranging from light to at times possibly heavy and as low as 8,000 ft. in southern Ohio. Some light precipitation existed en route, mostly in the form of drizzle. Cloud tops were 12,000 ft. and higher from St. Louis to southern Ohio ahead of the front, with ceilings of the lowest layers mostly 2,000 ft. or better but locally as low as 500 ft.

Reports of Icing

The record of communications shows that in his position report over Dayton, Ohio, at 9,000 ft. at 1200 (logged at 1203) the pilot reported light to moderate icing conditions and requested a lower altitude. That was his first mention of icing and his first request for lower altitude.

He again mentioned icing and requested a lower altitude when 9,000 ft. over Columbus at 1220, and at 1227 he reported rime ice and requested a lower altitude as soon as possible. Without wing and tail deicers he had no means of removing ice from those surfaces except by escape from the icing conditions, i. e. to another altitude.

Although icing was forecast for only the altitudes from 10,000 ft. up, it actually occurred at altitudes as low as 8,000 ft. After flying in an icing condition in excess of 30 min., Pilot Silva received clearance to descend to 8,000 ft., and at 1237 he reported leaving 9,000 ft. This was his last communication.

As shown by his communications, the pilot first reported icing conditions in the vicinity of Dayton. These conditions were not in accordance with the forecast he had received.

He requested a change to 5,000 ft. altitude but other traffic prevented the granting of that and other requests for a lower altitude assignment.

If icing conditions and the lack of wing deicers made his problem at that time an urgent one, he did not state that urgency, nor did he request additional information on the weather ahead.

FINDINGS

On the basis of all available evidence the Board finds that:

1. The aircraft and both members of the crew were properly certificated for the flight involved.

2. Company records indicate that the aircraft was loaded within allowable limits as to weight and center of gravity.

3. Pilot Silva was familiar with the forecasts of ice over the route involved, at altitudes of 10,000 ft. and above, and he

Fairchild Engine Division's New Plant and Gas Turbine Laboratory present OUTSTANDING ENGINEERING OPPORTUNITIES

Fairchild Engine Division is now expanding its engineering staff in its new plant and Gas Turbine Laboratory at Deer Park, Long Island, New York, and there are outstanding positions available for experienced engineers.

Investigate these opportunities:

MECHANICAL DESIGN ENGINEERS

For mechanical design of turbojet engines and components, and to conduct preliminary design study investigations on gas turbine engines.

MECHANICAL DESIGN ANALYTICAL ENGINEERS

To work closely with design engineers and to make recommendations as a result of analytical studies, with respect to stress analysis of lightweight rotating machinery, vibration analysis, cycle analysis investigations, analysis of mechanical component functionings and general structural problems.

RESEARCH ENGINEERS

Advanced degree, preferably in the fields of applied physics, chemistry, aerodynamics or applied mechanics. Also: engineers with supersonic aerodynamics background with high speed aircraft or wind tunnel testing.

INSTRUMENTATION ENGINEERS

Electronic-Mechanical Instrumentation Engineers for mechanical and aerodynamic testing. Electronic background essential for automatic data systems.

DEVELOPMENT ENGINEERS

Aeronautical and Mechanical Engineers to plan, supervise and conduct development test programs with gas turbine engines and components.

EQUIPMENT ENGINEERS

Familiar with mechanical test equipment design, including high speed rotating machinery and equipment.

ENGINE VIBRATIONS ENGINEERS

To determine means of measuring stress and shock loads in test articles. Area of operations is concerned with turbine engine vibration characteristics associated with high speed rotating parts subject to high temperatures and high stress loads.

And, Engineers with experience in other allied mechanical or aeronautical fields such as:

Compressor Aerodynamic Designers; Performance Analytical Engineers; Engine Controls Engineers; Test Engineers; Equipment and Product Drafting Checkers, and Mechanical Design Layout Men.

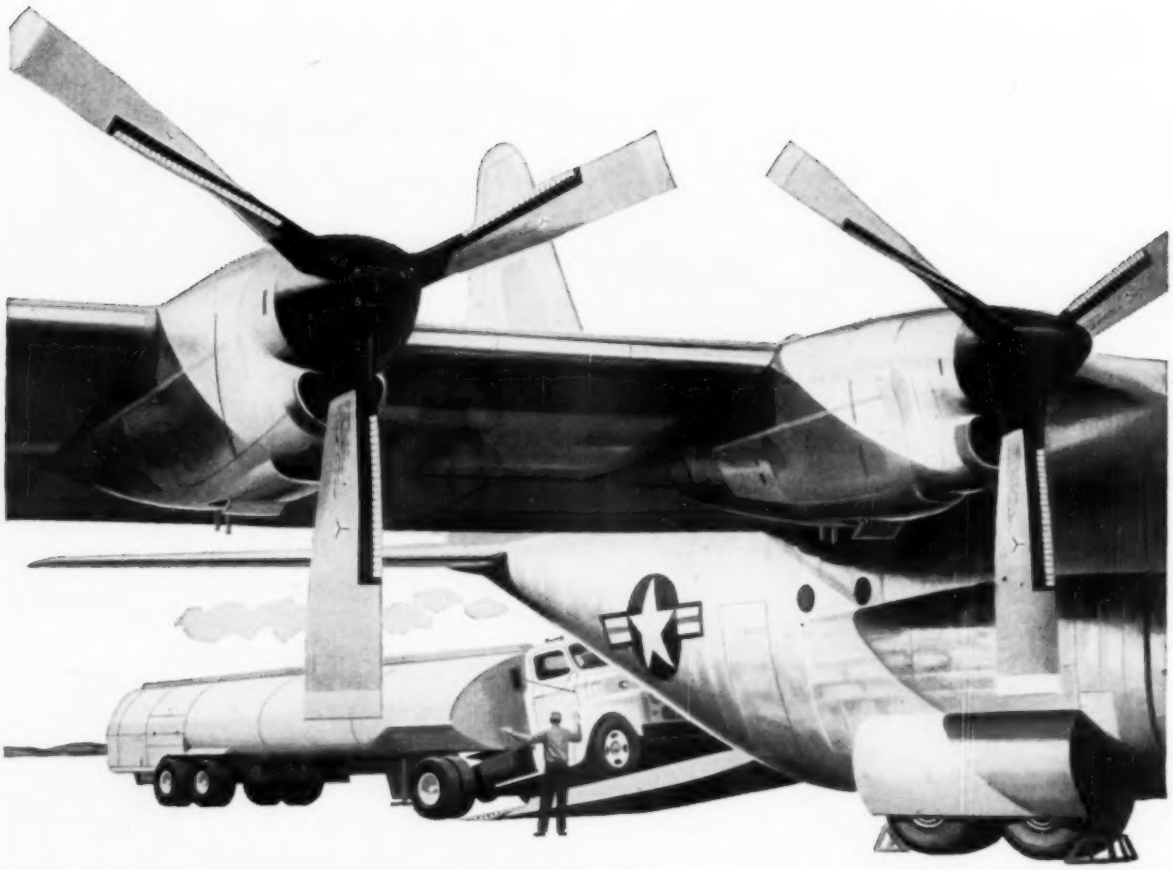
Please Contact Felix Gardner

FAIRCHILD

ENGINE DIVISION • DEER PARK, L. I., N. Y.

A Division of Fairchild Engine and Airplane Corporation

...WHERE THE FUTURE IS MEASURED IN LIGHT-YEARS!



Air Force Chooses Aeroproducts Propellers

FOR LOCKHEED C-130 HERCULES

USAF's first Turbo-Prop transport – the versatile C-130 Hercules – now is being equipped with the proved team of Aeroproducts Propellers and Allison Turbo-Prop engines.

A program of extensive research and testing of Aeroproducts turbo-propellers for the Hercules was conducted by the Propeller Laboratory at Wright-Patterson Air Force Base. In a period of five months, four qualification tests were made with a total of over 900 hours of running time.

Aeroproducts Propellers were chosen on the basis of these tests and of enthusiastic reports by pilots of MATS' 1700th Test Squadron who recently completed a successful flight evaluation program with Allison-powered aircraft.

In an eleven-month period, the 1700th accumulated 3000 hours of flight test time on two Convair YC-131C aircraft powered with YT56 engines and Aeroproducts Propellers. Within one day each of the two aircraft was flown 23 hours and 10 minutes out of the 24, and in the final four months of the program each aircraft was flown an average of eight hours per day. During this evaluation program, the propeller overhaul time was raised to 1000 hours. This program effectively demonstrated the unmatched dependability of the Allison-Aeroproducts Turbo-Prop package.

The Aeroproducts Propeller blade is of hollow steel construction, having solid steel ribs integral with the thrust side of the blade. No filler material is required in the hollow cavity. It is heat-treated to C30-C36 hardness, with an average tensile strength of 150,000 psi–providing the maximum abrasion resistance attainable on present-day propeller blades.

Allison Turbo-Prop power gives the Lockheed C-130 the ability to fly cargo faster and at less cost than any other combat transport.

Building for today . . . Designing for tomorrow

Aeroproducts

Allison Division of General Motors • Dayton, Ohio

knew the limitations of the deicing equipment on his aircraft.

4. The flight encountered icing conditions at cruising altitude of 9,000 ft.

5. Traffic prevented ARTC from assigning a lower altitude when so requested several times by Pilot Silva.

6. After Pilot Silva reported difficulty in maintaining airspeed and altitude, ARTC assigned the 8,000-ft. level and the pilot reported leaving 9,000 ft. at 1237.

7. At low altitude the aircraft lost much of the vertical surface in its tail group and struck the ground at a steep angle.

8. No emergency was declared.

PROBABLE CAUSE

The Board determines that the probable cause of this accident was the accumulation of enough ice to result in loss of control and the subsequent shedding of vertical surfaces from the tail group of the aircraft.

By the Civil Aeronautics Board:

/s/ James R. Durfee
/s/ Joseph P. Adams
/s/ Chan Gurney
/s/ Harmar D. Denny

SUPPLEMENTAL DATA

The Civil Aeronautics Board was notified of this accident at 1440, Dec. 29, 1955. An investigation was immediately started in accordance with the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended.

Aircraft Operator

Gulf Oil Corporation, Gulf Building, Pittsburgh, owned and operated the aircraft involved, which was used primarily for transportation of its management personnel on company business. It was one of two aircraft so owned, stationed at Tulsa.

Flight Personnel

Pilot Gordon Whewell Silva, age 46, held a commercial pilot certificate and was rated to fly Douglas DC-3s and Lockheed 18s on instruments. He had accumulated an estimated 9,000 hr.

Copilot Lloyd Littleton Cotton, age 38, held an aircraft and engine mechanic license and also was licensed as a commercial pilot. He had logged 983:35 hours and was rated to fly single- and multi-engine land aircraft and to act as a flight instructor. He did not hold an instrument rating.

The Aircraft

Lockheed 18-56 (Lodestar), N 33366, manufactured in March 1943, was purchased by Gulf Oil Corporation in 1947 and had been flown 4,372 hr. since that date. A major overhaul of the airframe was completed March 18, 1953, and the aircraft had been flown 1,656 hr. since that date. Its two engines, Wright 1820-72, had 141:05 and 40:10 hr., and its propellers, Hamilton Standard 23E50-471, had 924 hours since overhaul.

On April 7, 1954, CAA approval was given to alteration consisting of removal of extensions (called bat wings) which had been attached to the training edges of the wings on Nov. 9, 1947.

In August, 1949, deicer boots, which had been installed on the wing and tail surfaces on Jan. 21, 1948, were removed.

DESIGN ENGINEERS

and related professional fields of Stress, Weights and Balances, Tool Engineers, Chemical Processes, Thermodynamics

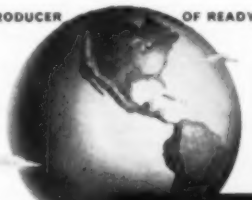
FOR A BETTER WAY OF LIVING

live near beautiful San Diego, California in lovely Chula Vista on the bay. Beaches, mountains, desert resorts, Hollywood, Old Mexico all nearby – outdoor family living in scenic surroundings and America's finest year-round climate.

AND A BIGGER FUTURE

learn about Rohr and the unusual personal security and opportunity you find here at this large, progressive, growing Company. Learn about the new, challenging engineering programs at Rohr, the sound management policies, personal benefits, chances for rapid advancement, company-wide team spirit – and other career advantages that do make Rohr Aircraft Corporation a better place for you to work for a bigger future.

WORLD'S LARGEST PRODUCER OF READY-TO-INSTALL POW-R-PAX FOR AIRPLANES



ROHR AIRCRAFT CORPORATION

Please write giving complete details and we will answer immediately.

J. L. Hobel
Industrial Relations Manager
Rohr Aircraft Corporation
Chula Vista, California
Dept. 27
9 miles south of San Diego on cool San Diego Bay

Engineers...

Look ten years ahead!

A Douglas engineer lives here

Will your income and location allow you to live in a home like this... spend your leisure time like this?

They can...if you start your Douglas career now!

Douglas has many things to offer the career-minded engineer!

...there's the stimulating daily contacts with men who have designed and built some of the world's finest aircraft and missiles!

...there's enough scope to the Douglas operation so a man can select the kind of work he likes best!

...there's security in the company's $2 Billion backlog of military and commercial contracts!

...and there's every prospect that in 10 years you'll be where you want to be professionally, and you'll be in both the income level and geographical location to enjoy life to its full.

For further information about opportunities with Douglas in Santa Monica, El Segundo and Long Beach, California and Tulsa, Oklahoma, write today to:

DOUGLAS AIRCRAFT COMPANY, INC.
C. C. LaVene, 3000 Ocean Park Blvd.
Santa Monica, California

DOUGLAS **First in Aviation**

EMPLOYMENT OPPORTUNITIES

The Advertisements in this section include all employment opportunities—executive, management, technical, selling, office, skilled, manual, etc.

Positions Vacant
Positions Wanted
Part Time Work

Civil Service Opportunities
Selling Opportunities Wanted
Selling Opportunities Offered

Employment Agencies
Employment Services
Labor Bureaus

DISPLAYED ——**RATES**—— **UNDISPLAYED**

The advertising rate is $27.60 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on a column—3 columns—30 inches to a page.

Subject to Agency Commission.

$2.10 per line, minimum 3 lines. To figure advance payment count 5 average words as a line.

Box Numbers—counts as 1 line.

Position Wanted ads are ½ of above rate.

Discount of 10% if full payment is made in advance for 4 consecutive insertions.

Not subject to Agency Commission.

Send NEW ADS to Classified Advertising Div. of AVIATION WEEK, P.O. Box 12, N. Y. 36, N. Y.

TEST ENGINEERS

DO YOU LIKE YOUR ENVIRONMENT?

Investigate the Environment created at AC for its Advanced Development Programs on Missile Guidance and Aircraft Fire Control Systems.

OUR ENVIRONMENTAL LABORATORY

is one of the most Versatile Laboratories in the country and is in the process of a Major, Permanent Expansion. Men hired will enjoy working with the finest of test equipment and facilities, together with top men of the field.

We are currently engaged in the following Types of Test Activities:

VIBRATION TESTING
COMPLEX WAVE ANALYSIS
LOW TEMPERATURE - ALTITUDE
HIGH TEMPERATURE
RELIABILITY EVALUATION
INSTRUMENTATION

Write Mr. J. Heffinger
Supervisor of Salaried Personnel

AC
The Electronics Div.
General Motors Corp.
Milwaukee 2, Wis.

RESEARCH and DEVELOPMENT
Attractive Openings—All Levels

AERODYNAMICS — Structures
Flight Test — Dynamics
Design — Drafting

For ENGINEERS with and without Rotary Wing experience

Your resume will be treated confidentially and will receive prompt attention. Write to

Administrative Engineer
KELLETT AIRCRAFT CORP.
Box 468, Camden 1, N. J.

Flutter and Vibration Supervisor
T-37 Twin Jet Trainer Project

At least 5 years experience; B.S. Degree minimum, M.S. preferred; in either Aeronautical or Mechanical Engineering.

Structures Engineer Supervisor

- Commercial Engineer with 5-7 years experience
- Should have supervisor aptitude and theoretical interest in structure.

CESSNA

If you meet these requirements and are interested in an unlimited opportunity with the World's Leading Producer of Executive Aircraft, send your resume and recent photograph to Professional Placement Supervisor, Dept. "AW", Cessna Aircraft Company, 5800 East Pawnee Road, Wichita, Kansas. (No phone calls please).

THERMO MEN
for CONVERTIPLANE assignment

Interest and/or experience in power plant evaluation to engage in analysis, design, and tests of propulsion components embracing the entire range of Helicopter and Convertiplane power plant systems.

Beginning as well as supervisory positions are available for work in gas turbine engines, compressors, pressure jets, heat-transfer, thermodynamics, combustion analysis, compressible flow, and related activity.

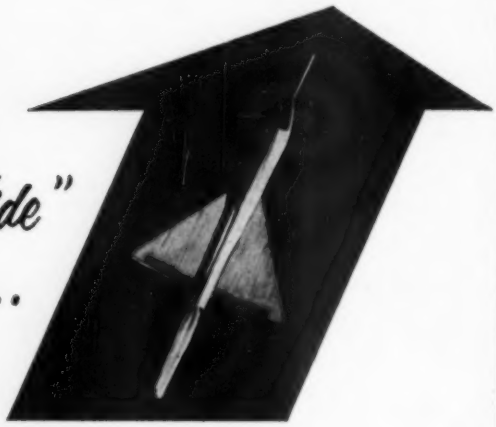
Mail experience resume in confidence to:

TECHNICAL PLACEMENT SUPERVISOR
Box 516, St. Louis 3, Missouri

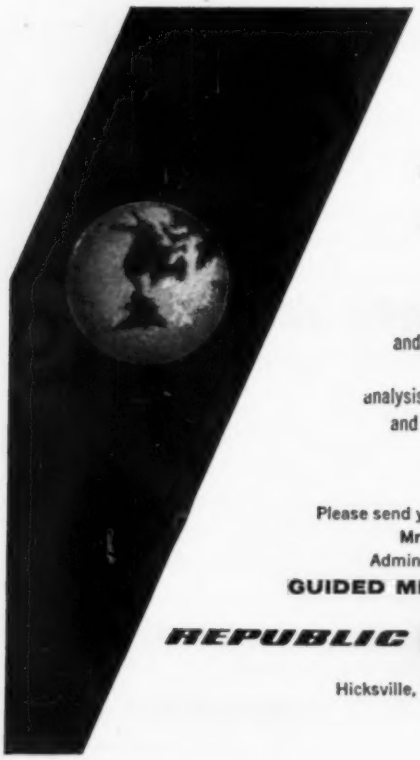
McDONNELL AIRCRAFT CORPORATION

ENGINEERS

"Space-Wide" in Scope...



...are the few select openings now available in Republic's growing Guided Missiles Division. Our staff is fully engaged in high priority development programs for missiles systems employed with bomber defense, guidance and controls problems and upper atmosphere research. New contract awards have created these attractive positions offering scientists and engineers challenging technical assignments. Our diversified work program provides an incentive to men who wish to join the young, progressive division of a long-established aviation leader.



OPERATIONS RESEARCH

Engineers needed with experience in operations research, weapons system evaluation, system effectiveness as related to guided missiles, ordnance and fire control fields.

AERODYNAMICS

Men with experience in stability and control, trajectory computation, wind tunnel testing, air load analysis, skin temperature computation, and aerodynamics heating problems.

Please send your complete resume to
Mr. R. R. Reissig
Administrative Engineer
GUIDED MISSILES DIVISION

REPUBLIC AVIATION

Hicksville, Long Island, New York

ENGINEERING for the FUTURE

Are you an engineer or specialist interested in making your contribution to the advancement of highly complex aeronautical test facilities?

SUPERSONIC & HYPERSONIC WIND TUNNELS and POWER PLANT TEST LABORATORIES

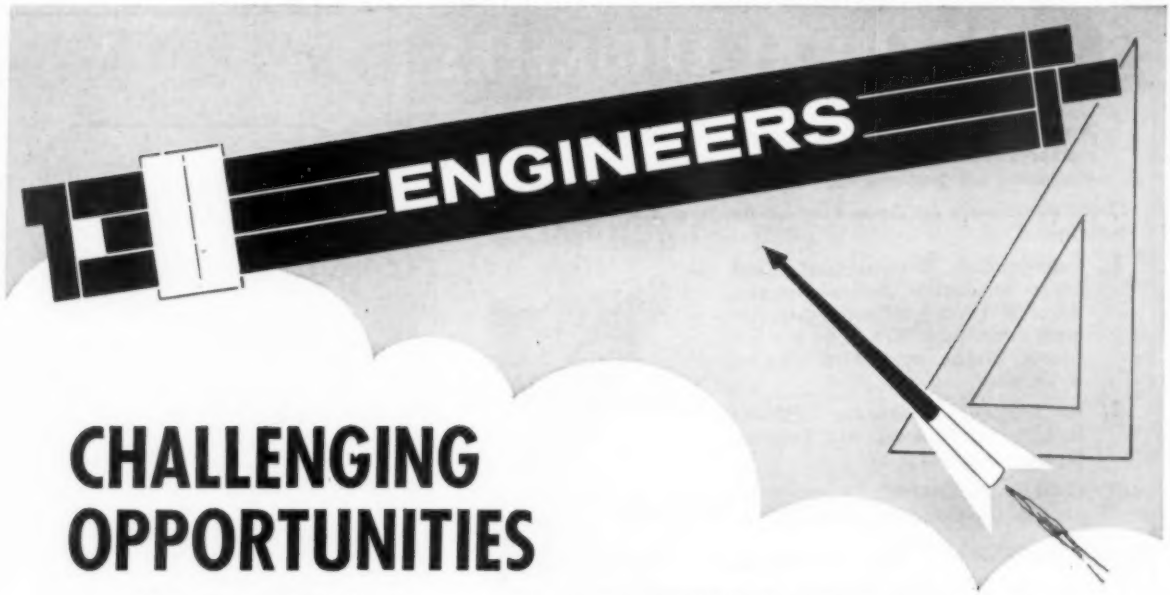
Sverdrup & Parcel, Inc., designers of the Arnold Engineering Development Center and many other installations, is engaged nationally and internationally in design and consultation of advanced and unusual test facilities for national defense and for private industry.

Openings exist for two or three well qualified men in senior design or project engineer categories and for two or three men with lesser experience but good promise. The wide variety and unique character of our work offers challenging problems and provides excellent opportunity for individual development and advancement.

Starting salary and extent of responsibility are commensurate with ability and background. Fringe benefits include an attractive Employee Benefit Plan which provides insurance features and retirement income; paid vacations, holidays and sick leave; overtime rates; Blue Cross plan. Probably the greatest benefit is the opportunity to practice professional engineering in a professional organization under professional conditions.

Your letter of inquiry will receive prompt attention and reply. Please write fully advising availability for personal interview, to—

SVERDRUP & PARCEL, INC.
Engineers—Architects
915 Olive St. Louis 1, Mo.



CHALLENGING OPPORTUNITIES

IN
- **Avionics**
- **Computers**
- **Jet Engine Fuel Controls**
- **Inertial Systems**
- **Missile Guidance**

WITH AC THE ELECTRONICS DIVISION OF

General Motors

ALL GRADUATE ENGINEERS are offered permanent job opportunities. We extend a cordial invitation to every deserving Engineer and Designer to write us their wants. We may be able to supply the square hole for the square peg!

YOUR FUTURE depends on your making the right connection with the right firm as quickly as possible.

The men hired will enjoy working with some of the top men in the field and with the finest test, research and development facilities. GM's long-standing policy of decentralization creates individual opportunity and recognition.

Why not send us full facts about your education, work background, etc. We will do all we can to treat your application with the fullest confidence.

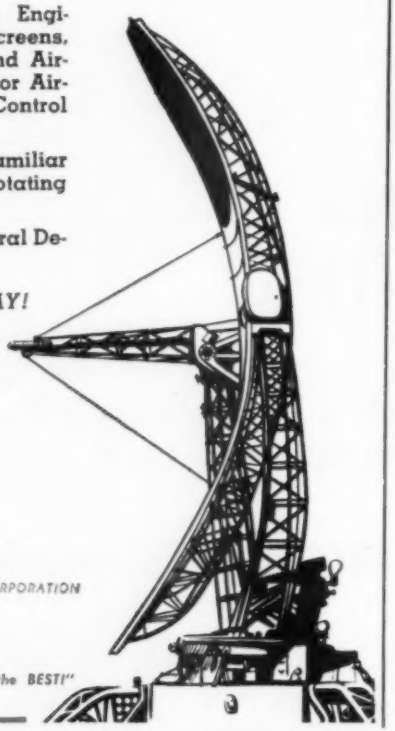
AC SPARK PLUG — THE ELECTRONICS DIVISION
GENERAL MOTORS CORPORATION
MILWAUKEE 2, WIS. — FLINT 2, MICH.

STRUCTURAL ENGINEERS

A new and important era is dawning at CROSLEY! Here are career opportunities that offer almost unlimited scope and endeavor for projects that stir the creative imagination.

There are needs in these current fields of CROSLEY activity:

1. **Experienced Aeronautical Engineers to design Radar Screens, Aircraft Turrets, Missile and Aircraft Airframes, Housings for Airborne Radar and Fire Control Systems.**
2. **Mechanical Engineers familiar with Radar Antenna and Rotating Equipment Design.**
3. **Civil Engineers with Structural Design Background.**



Get the CROSLEY story TODAY!

Please Send A Written Resume To:

D. B. Nason
Vice President and Director of Engineering
Dept. T

Crosley DIVISION
AVCO MANUFACTURING CORPORATION

2630 Glendale-Milford Road
Evendale, Cincinnati 15, Ohio

"Known for the NEWEST — Respected for the BEST!"

CONTROLS ENGINEER

A few openings have developed in our organization for well qualified engineers who can participate in, and lead, in these areas:

- **Analysis and development of controls systems and components**
- **Control testing of systems and components**

Mature engineering judgment is essential and at least 3 to 5 years' experience in controls systems, servo-mechanisms and mechanical servos, with emphasis on the latter, and in some cases, proven ability in supervision.

These are not typical engineering positions. The work is of an advanced nature and opportunities for promotion are clearly outlined. Salary is commensurate with ability and is coupled with many additional benefits.

The location in the Northeast is fine for family living. The operation offers stability in its product appeal to both commercial and military markets.

For further information write, giving details of education and experience, to:

P-1931 Aviation Week
330 W. 42 Street, New York 36, N. Y.

Abilities demanded by this position call for an engineer qualified to earn up to $15,000

Project Leader—
AIRBORNE FIRE CONTROL RADAR . . .

Specific accomplishments desired in: pulse radar transmitters, microwave techniques, timing and display circuits, servomechanisms. Capable of technical and administrative leadership of engineers.

•

Excellent salary will be only the first of many satisfactions in this unusual opening with an electronics pioneer and leader!

•

***To arrange confidential interview, send resume to**

P-1691, Aviation Week
330 W. 42 St., New York 36, N. Y.

ENGINEERS
SCIENTISTS

POSITIONS OPEN AT THE FOLLOWING LOCATIONS

CINCINNATI, OHIO
or IDAHO FALLS, IDAHO

at all levels of experience

Structural • Reactor
Reactor Design • Nuclear
Nuclear Power Plant
Electrical • Mechanical
Electronic • Chemical
Ceramic
Aerodynamics • Physics
Thermodynamics
Facilities Planning
Physical Chemistry
Metallurgy • Mathematics

...the natural place for creative men to apply their talents today

AIRCRAFT NUCLEAR PROPULSION DEPARTMENT
of GENERAL ELECTRIC

One of the nation's major research and development programs is in progress today at General Electric – the design and development of engine applications for nuclear powered flight.

Significant advances have been made by the group of outstanding engineers and scientists at work at GE's excellent facilities in Cincinnati and at Idaho Falls. Success in this adventurous undertaking is just around the corner – and *you* can share in it. The scope of the program is broadening, making room for a number of high calibre men, both *with* – and *without* – previous nuclear experience.

If you have a creative mind – unshackled by conventional concepts – yet soundly based in one of the fields listed below – you may be just the man to make valuable contributions to this history-making program in nuclear propulsion. The possibilities for future growth in this field are practically unlimited, both in military and commercial aviation.

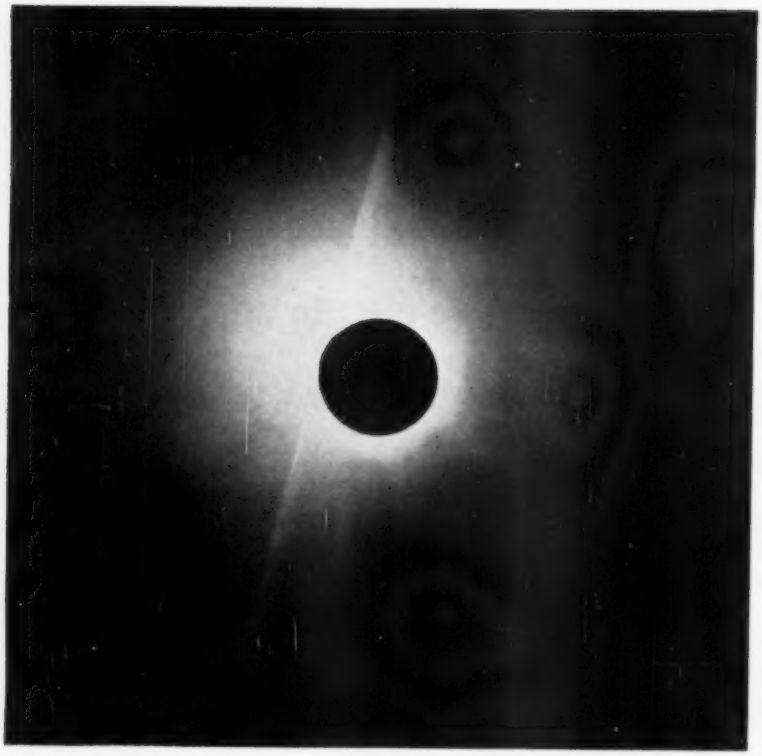
Your personal progress will be promoted in every way at GE. Through company sponsored courses, contact with acknowledged leaders in atomic development, and a Full Tuition Refund Plan for graduate study. There's a firm promotion-from-within policy here; frequent evaluations of individual contributions. Salaries are as high – or higher than – those paid for comparable work anywhere.

Address reply in confidence stating salary requirements to the location you prefer.

GENERAL ELECTRIC

Mr. W. J. Kelly
P.O. Box 132
Cincinnati 15, Ohio

Mr. L. A. Munther
P.O. Box 535
Idaho Falls, Idaho



what does outer space mean to you?

Because of an unmatched record of scientific experience in upper-air research as builders of the Viking Rocket series for the Navy, Martin was awarded the prime contract on the project known as ESV VANGUARD—the Earth Satellite Vehicle that will take its place in history as man's first exploratory step in the conquest of the final frontier, space itself.

What does space mean to you as an engineer?

Today, no other aircraft company in the world can give you more penetrating answers to that question. And tomorrow...

If you are interested in the greatest engineering adventure of our time, contact J. M. Hollyday, Dept. AW-06, The Martin Company, Baltimore 3, Maryland.

MARTIN

Aeronautical Engineers . . . to $10,000 in this stimulating Airborne Weapons Systems Project

You will be challenged by the severe environmental conditions encountered in supersonic flight. New concepts in mechanical designs are required to deal with previously unexplored states of temperature, altitude, shock, vibration and humidity. Degree, plus experience in design of aircraft structure and mechanisms or design, of aircraft control instruments.

As a mechanical or aeronautical design engineer, grow now thru this truly advanced effort, on a team of creative engineers with the world leader in electronics!

To arrange confidential interview, send resume to

P-1694, Aviation Week
330 W. 42 St., New York 36, N. Y.

OPEN DOOR *for open minds*

This is Litchfield Park, Arizona. Located 18 miles west of Phoenix, this ideal "vocationland" is a modern monument to the growth of Goodyear Aircraft. And a major factor in this continued growth and diversification is the freedom of creative thought and expression enjoyed by Goodyear Aircraft engineers.

Here, engineers know that *every* idea has a chance. And in transforming their ideas into realities, Goodyear Aircraft engineers find the stimulation of creative challenge and the satisfaction of realistic accomplishment.

If *you* are a creative engineer with faith in your ideas and confidence in your ability to make them work, here's your opportunity to become a part of this great creative team. For, because of our continued growth, we must expand our engineering staffs at both Litchfield Park and Akron, Ohio.

Assignments on a variety of highly significant projects are available to engineers in all specialties. The most modern equipment and facilities, including one of the largest computer laboratories in the world, permit application of the most advanced technology.

Salaries and benefits are, of course, liberal. And for those who wish to continue with academic studies, company-paid tuition courses leading to advanced degrees have been established at nearby colleges.

For further information on *your* career opportunities at Goodyear Aircraft, write: Mr. C. G. Jones, Personnel Department, Goodyear Aircraft Corporation, Akron 15, Ohio.

They're doing big things at

GOODYEAR AIRCRAFT

THE TEAM TO TEAM WITH in AERONAUTICS

DEVELOPMENT ENGINEERS

Honeywell's Aeronautical Division is one of several Honeywell Divisions specializing in automatic controls. At Aero the main specialties are guidance and automatic flight control of missiles and aircraft, airborne instrumentation, airborne servomechanism components and jet engine controls.

■ Top development positions are open for aeronautical, mechanical and electrical engineers. This means complete design and development responsibility for components and systems in the field of autopilots, fuel measurement systems, inertial guidance systems, vertical and rate gyros, stabilization platforms, and many others.

■ As a design engineer you will provide technical direction for draftsmen, technicians, model makers and evaluation engineers essential to the project. An engineering degree or its equivalent plus practical experience with related or similar equipment is required.

CONSIDER THESE ADVANTAGES

■ Minneapolis, the city of lakes and parks, offers you metropolitan living in a suburban atmosphere. No commuting.

■ Your travel and family moving expenses paid.

■ Salaries, insurance-pension programs, plant and technical facilities are all first-rate.

■ Honeywell, leader in control systems, manufacturers of over 10,000 different products, offers unusual diversification and variety. A sound growth company, continually expanding, it offers permanent opportunity to you.

WRITE TO US

If you are interested in a career at Honeywell, call collect or send your resume to Bruce Wood, Dept. AW-6-98, Aeronautical Division, 2600 Ridgway Road, Minneapolis 13.

MINNEAPOLIS **Honeywell**

First in Controls

Now a wonderful career opportunity: be a flight officer with United Air Lines!

Did you know that if you have a commercial pilot's license with 165 hours or more—no multi-engine time required—you may qualify to become a United Air Lines Flight Officer?

Your basic qualifications and aptitudes are more important than number of hours flown. United's Flight Training Center at Denver, Colo., offers unusually thorough training programs, with pay, for all new flight personnel.

Pay is excellent: you get $485 a month as soon as you go on line duty, and increases at regular intervals. You get a broad insurance program, retirement income plan, many other benefits.

Here are your other basic requirements: you must be a U. S. citizen, 21-30, between 5'7" and 6'4" in height, a high school graduate and able to pass a flight physical without waivers. Applicants with C.A.A. instrument rating and superior flight qualifications will be accepted through age 32.

Your future is assured by United's expansion program. Send for the booklet today!

C. M. Urbach, Supt. of Placement
UNITED AIR LINES
Operating Base, Dept. AVIA-6
Stapleton Airfield, Denver 5, Colorado

Please send me your booklet that tells me how I can become a Flight Officer with United Air Lines.

Name.....

Street.....

City.....*Zone*.....*State*.....

what helps an engineer grow?

Answers by 3 outstanding Avco scientists reveal both the thinking and opportunity at Avco Research and Advanced Development Division.

"Technical support"

says Dr. J. P. Silvers, specializing in thermodynamics, hydrodynamics in reactor design; formerly with Navy Nuclear Power Division; now with Avco Research and Advanced Development.

"An engineer should be given plentiful technical assistance. His potential cannot be fully realized when his energies are consumed by routine duties."

"An atmosphere of inquiry"

says Eaton H. Draper, noted nuclear weapons systems expert and Engineering Manager of Avco Research and Advanced Development Division.

"Provide a climate which encourages a healthy questioning of the known, as well as the unknown, and an engineer will perform at his peak . . . and even beyond."

"Top-level associates"

says Dr. J. A. Kyger, noted authority on nuclear engineering; formerly Chief Scientist for Nuclear Power Division, U. S. Navy Bureau of Ships; now Project Director of Avco Research and Advanced Development Division.

"An engineer's development depends on mental stimulation provided by able associates. It's important at all levels and it is essential to a young engineer."

Helping talented engineers and scientists—at all levels—become more effective is the best way we, at Avco Advanced Development, know of helping our own growth. For outstanding men, Avco's long-range expansion—in missiles and in all the physical sciences—offers unprecedented opportunity. Write Dr. E. R. Piore, Vice-President in Charge of Research, Room 409-F, Avco Research and Advanced Development Division, Stratford, Conn., or Phone Bridgeport, Conn., DRexel 8-0431.

WANTED:
Leaders in the exploitation of new areas of Science

Physical Scientists
Advanced degree preferred in—Physics · Aerodynamics
Electronics · Metallurgy · Physical Chemistry · Mathematics

Engineers
Electronic · Mechanical · Aeronautical
Chemical

avco Research and Advanced Development division

avco defense and industrial products

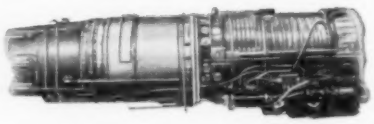
combine the scientific skills, and production facilities of 3 great divisions of Avco Manufacturing Corp.: Research and Advanced Development; Crosley; Lycoming—which currently produce power plants, electronics, airframe components, and precision parts.

AC
ELECTRONICS DIVISION

NEEDS HYDRAULIC RESEARCH ENGINEERS

To Develop TEST FACILITIES for Jet Engine Fuel Control Systems and Components.

Working with:
High Energy Fuels at Extremes of Temperatures and High Pressures



Test Stands
Environmental Test Cells
Remote Instrumentation

Servo Operated Afterburner Fuel Controls, Inlet Temperature and Turbine Speed Sensing Electro-Hydraulic Servo Controls.

Applicant should have B.S. Degree Plus 4-6 Years Experience Relative to Hydraulic Engineering, Valve Design, Hydraulic Servos, Instrumentation and Testing of Fluid Control Devices, or Other Associated Fields.—Write to Mr. J. Heffinger, Supervisor of Salaried Personnel

AC THE ELECTRONICS DIVISION
GENERAL MOTORS CORPORATION
MILWAUKEE 2, WISCONSIN also FLINT 2, MICHIGAN

SOUTHERN CALIFORNIA COOPERATIVE WIND TUNNEL

Operated by CALTECH

The $14,000,000 Cooperative Wind Tunnel is specifically designed for testing and analysis of high-speed aircraft and guided missile development problems. We now have excellent openings for:

AERODYNAMIC ENGINEERS
TEST PROJECT ENGINEERS
COMPUTING ANALYSTS

For information on EMPLOYMENT OPPORTUNITIES write
Mr. J. N. Ewart
CALIFORNIA INSTITUTE OF TECHNOLOGY
Pasadena, California

INDIVIDUAL RECOGNITION
DIVERSIFIED ASSIGNMENTS
SMALL COMPANY ATMOSPHERE

ENGINEERS
typical assignments

OPPORTUNITIES FOR CAREER IMPROVEMENTS

JET AIRCRAFT
- Perform Propulsion Analyses
- Design Thrust Deflector
- Plan Flight Test Programs

HELICOPTER
- Conduct Accelerated Fatigue Analyses
- Design Rotor Head Mechanisms

COMMERCIAL
- Develop Cabin Heater System
- Design and Develop Air Conditioning and Pressurization System
- Conduct CAA Certification Program

For comprehensive information, write: Professional Placement Supervisor Dept. AW
Cessna
5800 East Pawnee • Wichita, Kansas
THE LEADING PRODUCERS OF BUSINESS AIRCRAFT

SUNDSTRAND AVIATION

Has Opportunities for

DESIGN ENGINEERS
MECHANICAL ENGINEERS
ELECTRICAL ENGINEERS
to Design and Develop

MECHANICAL-HYDRAULIC CONSTANT SPEED SYSTEMS

Please address complete resume, outlining details of your technical background to

MR. HOWARD EKSTROM
Personnel Director—

SUNDSTRAND AVIATION
2531 11th, Rockford, Illinois

An employment advertisement in this EMPLOYMENT OPPORTUNITIES section will help you find the engineers you need. It's an inexpensive, time saving method of selecting competent personnel for every engineering job in the Aviation field.

TO THE FINE ENGINEERING MIND
SEEKING THE CHALLENGING PROJECTS IN

AERODYNAMICS

AERODYNAMIC ENGINEERS AND SCIENTISTS are urgently needed now at Convair in beautiful, sunny San Diego, California. Excellent career opportunities exist for junior and senior engineers for aerodynamics, performance and heat transfer analyses related to advanced projects in the supersonic Mach number range. A balanced background in experimental and theoretical aerodynamics is ideal for these positions. Analytical aerodynamic studies using analogue and digital computers are an integral part of this work. Challenging positions are also available for aerodynamicists experienced in research and development wind tunnel and firing range tests.

CONVAIR offers you an imaginative, explorative, energetic engineering department... truly the "engineer's" engineering department to challenge your mind, your skills, your abilities in solving the complex problems of vital, new, long-range programs. You will find salaries, facilities, engineering policies, educational opportunities and personal advantages excellent.

SMOG-FREE SAN DIEGO, lovely, sunny city on the coast of Southern California, offers you and your family a wonderful, new way of life ... a way of life judged by most as the Nation's finest for climate, natural beauty and easy (indoor-outdoor) living. Housing is plentiful and reasonable.

Generous travel allowances to engineers who are accepted. Write at once enclosing full resume to: H. T. BROOKS, ENGINEERING PERSONNEL DEPT. 118

CONVAIR

A Division of General Dynamics Corporation

3302 PACIFIC HIGHWAY · SAN DIEGO, CALIFORNIA

STAFF ENGINEER

Design & development of air data computers. Heavy experience in airborne electronics computers & instruments required. At least 5 to 10 years of experience in electronic design essential.

TOP SALARY FOR TOP MAN

SERVOmechaNISMS INC.

SEND RESUME TO

POST & STEWART AVES.
WESTBURY, LONG ISLAND

DIGITAL ENGINEERS

for Long-Range Programs
Airborne Control Applications

Challenging assignments with opportunity to carry your ideas though to final hardware and operational flight testing in:

- **Computer Organization**
- **Logical Design**
- **Advanced Circuit Design**
- **Laboratory Development**
- **Packaging and Reliability**

Salary—up to $12000
(Commensurate with experience)

Send resume in confidence to:

Manager of Technical Personnel
Dept. 674

ARMA

Division of
American Bosch Arma Corporation
Roosevelt Field, Garden City
Long Island, N. Y.

WANTED SALESMAN

To sell fabrics and items made of fabric to the aircraft and guided missile industries. Must have experience in either fabrics or aircraft field. Willing to travel full time. Work for one of the largest and best known companies in its field. Complete benefits, security, and incentive plans. Write W. E. Carson, C. R. Daniels, Inc., Daniels, Maryland, stating all particulars in first letter.

ENGINEER FIELD SERVICE

To contact Airforce and Navy operating bases. Must have about five years experience with airframe or engine company in field service department. Should be 28 or over, and have college and engineering background. Excellent opportunity in company with liberal employee benefits including profit sharing retirement plan.

Address replies to:

J. M. Wehrly, Personnel Manager
Wm. R. Whittaker Co., Ltd.
915 North Citrus Avenue
Los Angeles 38, California

BE SURE HE'S A
SKILLED PILOT

Company taken to the air? "P-E-A" will supply exactly the pilot you specify . . . carefully screened, psychologically tested . . . dependably safe! Complete consultation service.

——PILOTS EMPLOYMENT AGENCY——
Teterboro (N. J.) Airport, Atlas 8-1214
Lockheed Air Term., Burbank, Cal., THornwall 4-3646

REPLIES (Box No.): Address to office nearest you c/o this publication, Classified Adv. Div.
NEW YORK: P. O. Box 12 (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)
LOS ANGELES: 1125 W. 6th St. (17)

POSITION VACANT

Analysts—Traffic & Economics. Executive offices in eastern city. Age 25-35 preferred P-1155, Aviation Week.

POSITIONS WANTED

Pilot. ATR. 7800 hours. 4200 multi-engine command, age 37, married, excellent references. Available two weeks. PW-1771, Aviation Week.

Engineer—10 years experience aircraft design, equipment and hardware. Would like sales, service or other engineering employment in Florida. PW-1958, Aviation Week.

Personnel Managers—Need experienced Engineers and Technicians? We offer a booklet especially prepared to help you solve this problem. Write for your "free" copy of "Reservoir of Engineers and Technical Men." Classified Adv.—Aviation Week, P. O. Box 12, New York 36, N. Y.

SPECIAL SERVICES TO THE AVIATION INDUSTRY

OVERHAUL & MAINTENANCE

Remmert-Werner

Inc. of ST. LOUIS, Lambert Field — Inc. of TOLEDO, Express Airport

Specialists in
DC3
LODESTAR — Maintenance, Inspection
TWIN BEECH — Overhaul, Conversion

PARTS & SUPPLIES

NAVCO INC.

Lambert Field
St. Louis, Mo.
PErshing 1-1710

Has all Parts and Supplies for Executive
DC-3 LODESTAR BEECH
Airframe — Bendix, Collins, Lear, Sperry, Wilcox
Engines — P&W, Continental, Wright
Radios — A.R.C., Goodrich, Goodyear

SALES REPRESENTATIVES

GEORGE E. HARRIS & CO. INC.

SALES—ENGINEERING REPRESENTATIVES
3241 East Douglas — Wichita, Kansas
Regional Offices
KANSAS CITY, FT. WORTH, ST. LOUIS,
DALLAS, CEDAR RAPIDS, DENVER & SEATTLE

Your Inquiries to Advertisers Will Have Special Value . . .

—for you—the advertiser—and the publisher, if you mention this publication. Advertisers value highly this evidence of the publication you read. Satisfied advertisers enable the publisher to secure more advertisers and—more advertisers mean more information on more products or better service—more value—to YOU.

CLASSIFIED SEARCHLIGHT SECTION ADVERTISING

BUSINESS OPPORTUNITIES — EQUIPMENT - USED or RESALE

FOR SALE

AIRCRAFT CABLE and WIRE

20,000 ft.—Aluminum Electric Cable AL-1 AN-C-161 MCI 51702

75,000 ft.—Aluminum Electric Cable AL-4 AN-C-161 MCI 51702

20,000 ft.—Aluminum Electric Cable AL-6 AN-C-161 MCI 51702

50,000 ft.—Aluminum Electric Cable AL-8 AN-C-161 MCI 51702

4,000 ft.—ALUMINUM ELECTRIC CABLE 0 Ga.—ANJC48A-NAU-AER-EP360

8,000 ft.—ALUMINUM ELECTRIC CABLE 1 Ga.—ANJC48A-NAU-AER-EP360

17,000 ft.—ALUMINUM ELECTRIC CABLE 4 Ga.—ANJC48A-NAU-AER-EP360

34,000 ft.—ALUMINUM ELECTRIC CABLE 8 Ga.—ANJC48A-NAU-AER-EP360

300,000 ft.—Copper Electric Cable 12 Ga. MIL-W-5274A Ty. 2 CL. 1

200,000 ft.—Copper Electric Cable 16 Ga. MIL-W-5274A Ty. 2 CL. 1

4,860 ft.—Copper Insulated Cable GE-57334 AN-2 MCI-58710

112,355 ft.—Copper Red-Black-White Wire Cond. 3 AN-22 MCI-58711

28,798 ft.—Lead Alumel Wire, Thermocouple AN-W-29A CL. B TY. 2

COMMERCIAL AIRCRAFT PARTS CO.
4101 Curtis Ave., Baltimore 26, Md.
Telephone: Curtis 7-3300

WRIGHT & PRATT WHITNEY AIRCRAFT ENGINES

FOR SALE

4	R-985AN1—used	6	R-1830-63—used
4	R-985AW3—used	63	R-1830-65—used
5	R-1820-50—new	49	R-1830-90B—used
5	R-1820-52—new	3	R-1830-90C—used
4	R-1820-60—used	5	R-1830-90D—used
3	R-1820-71—used	17	R-1830-92—used
5	R-1820-87—used	1	R-2600-22—used
25	R-1820-97—used	2	R-26-29—used
14	R-1820-97—ntso	2	R-2800-10—used
18	R-1820-56W—ntso	9	R-28-31—used
2	R-1820-66—ntso	2	R-2800-51—used
4	R-1820-102A—used	50	R-3350-23A—new
5	R-1820-205A—used	35	R-3350-57AM—ntso
9	R-1830-43—used	115	R-3350-57Am—used

WE ALSO CARRY A LARGE STOCK OF AIRCRAFT ENGINE PARTS

CALIFORNIA AIRMOTIVE • CORPORATION

7139 Vineland Avenue,
North Hollywood, California

POplar 5-6202
STanley 7-8374

Deal Directly with Owner

HANGARS

U.S. Navy type. 120' clear span by 200' depth Doors 120'x28'

All Steel Constructed. Excellent monetary saving and good delivery if you are considering the construction of a hangar of this size.

TRADE-AYER COMPANY
Linden Airport Linden, N. J.
Hunter 6-7690

FOR SALE or LEASE

If you or your company are looking for a clean, late model airplane in A-1 condition and ready to go, one of the following is sure to fill the bill:

D18S Twin Beechcraft.

1956 G Model Bonanza—85 Hours TT.

1954 E-225 Bonanza—570 Hours TT.

1951 Cessna 195—2100 Hours TT,

160 hours on engine and prop SOH. 27 channel Narco Simplexer, ADF, Narco Omnigator and many other extras.

GEORGE H. BAILEY COMPANY
3508 Quimby Arcade
Fort Wayne 6, Indiana

Weather Radar
INSTALLATIONS

AiResearch nose modification kit and radome for DC-3s.

- Exclusive 30-inch antenna installation
- Exclusive short wave guide run
- No limitation on air speed
- Lower installation costs
- **RCA, Collins, Bendix, X-Band, C-Band installed in DC-3, Lodestar and Convair airliners.**

Send for booklet R-1

THE GARRETT CORPORATION

AiResearch Aviation Service Division
International Airport, Los Angeles, Calif.

HELICOPTER

Hiller—Model UH-12B. Very low airframe and engine time.

Perfect Condition.

EAST COAST AVIATION CORPORATION
Bedford Airport Lexington 73, Mass.

RAS INCORPORATED

"Take a Heading for Reading"

for the BEST MAINTENANCE • OVERHAUL • MODIFICATION • INSTALLATION

READING AVIATION SERVICE, INC.

Municipal Airport Phone 3-3285 Reading, Pennsylvania

EXPERT REFINISHING
-in record time

Smart appearance as well as dependable performance is important in business aircraft. That is why business planes in ever increasing numbers are being repainted at Ohio Aviation. Our Paint Department is equipped to handle DC-3's down to the smallest aircraft—on a finishing system that gets your plane back into service with minimum delay. There are no short cuts, here. Complete stripping, etching and surface preparation, and a final spray coat of hot enamel guarantees a smooth, protective glistening coat—as glamorous and beautiful as the original finish.

Write, wire or phone Charlie Groff, Manager, Aircraft Service Department at Ohio Aviation for complete refinishing information. We're ready to serve you.

THE OHIO AVIATION CO.
Dayton Municipal Airport,
Vandalia, Ohio

HELICOPTERS
2 HILLER UH-12

3-Place - Dual Controls
New interiors
Both skid & float gear
Long range tank
Cabin heater
TT 630:00 540:00
One with 3 hrs. SOH
Other with 55:15 SOH

Spare parts for one year's operation.

"We Are Owners"

LEEWARD
AERONAUTICAL SALES, INC.
P. O. Box 233 Miami 48, Fla.

Sperry Zero Reader—Available June 15th—Used about 750 hours. Complete with altitude controller, go around button and all components. Fraction of original cost.
Wright R1820-205A—Zero time. All bulletins. Surplus to our needs. Make a modest offer. Would consider trades or credit against DME on either item.
J. S. LEWIS
P. O. Box 265, Elmira, New York
Telephone 7151

E-18S
Executive Beechcraft
NEW—

Manufactured: 1955 Actual certified flight hours: 19:00
[Repeat: nineteen (19) hours]

Purchased by well known industrialist direct from factory but never flown due to unusual circumstances.

Aircraft being offered for immediate delivery at a substantial savings below the original list price.

We own the aircraft offered.

Aircraft located our Fort Wayne base

Leeward
AERONAUTICAL SALES, INC.
P.O. BOX 210 FORT WAYNE, INDIANA

Grumman Mallard
SERIAL J-29

Now in overhaul—can be finished to your colors and specifications.

Airframe total time:	2300 hours
Airframe time SOH:	Zero hours
Engine time SOH:	50 hours

Sale or lease terms on request

WILLIAM C. WOLD ASSOCIATES
551 Fifth Avenue, New York 17, N. Y.
Cable: BILLWOLD Tel: Murray Hill 7-2050

for sale
De Havilland
DOVE

Airplane Time 1500 Hrs. . . . "Mark II Engines Total Time 850 Hrs."
Dual American Instruments. *Complete with spare parts and Wentworth Tools.*
Contact: Mr. Joe Barron
Ashland Oil & Refining Company
Ashland, Kentucky

Remmert-Werner
for
RADAR

Bendix C-band
R.C.A. X-band
Lambert Field St. Louis, Mo.

LOCKHEED LODESTAR
FOR SALE

50 Hours on P & W engines and 50 hours on props SOH. (Engines have 94 cylinders). 1500 Hours on airframe SOH. Only 600 hours since installation of beautiful new interior. Plane equipped with all the latest Bendix radio and navigation equipment. Now owned by a large corporation which has spared no expense in maintenance. Two spare engines, two spare cowlings and many spare parts—available for immediate delivery.

GEORGE H. BAILEY COMPANY
3508 Quimby Arcade Ft. Wayne, Ind.

We Buy DC-3 and C-47

—also components, fuselages, center sections. Prefer runout or needing work, airline, passenger, or cargo, Pratt & Whitney or Wright. State price, time, quantity, type engines.

We are not brokers
REMMERT-WERNER, INC.
Lambert Field St. Louis, Mo.

AIRPLANES WANTED

Need 50 Bonanzas, Navions, 180's, 170's, 170's, Aero Commanders, Twin Navions, Twin Beeches, etc.
Will Buy Dealers' Stocks New or Used
Vest Aircraft Co.'s Skyranch
BOX 5306, DENVER 17, COLORADO

HELICOPTER WANTED
Type 47D or 47G.

Would also consider Sikorsky S.51.
W-1938 Aviation Week
330 W. 42 St. New York 36, N. Y.

ADVERTISERS IN THIS ISSUE

AVIATION WEEK—JUNE 11, 1956

AEROPRODUCTS ALLISON DIV., GENERAL MOTORS CORP. 128
Agency—Kudner Agency, Inc.

AIRCRAFT EQUIPMENT TESTING COMPANY 98
Agency—Mahool Advertising, Inc.

AIRCRAFT MARINE PRODUCTS, INC. 88
Agency—M. Russell Berger, Inc.

AIR FRANCE 99
Agency—Buchanan & Co., Inc.

ALL AMERICAN ENGINEERING CO. 117
Agency—Gaynor, Coleman, Prentice, Varley, Inc.

ALUMINUM CO. OF AMERICA 93
Agency—Fuller & Smith & Ross, Inc.

AMERICAN MACHINE & FOUNDRY CO. 24
Agency—Fletcher D. Richards, Inc.

AUTONETICS DIVISION NORTH AMERICAN AVIATION 101
Agency—Batten, Barton, Durstine & Osborn, Inc.

AUSTENAL LABORATORIES, INC. (MICROCAST DIVISION) 6
Agency—Gaynor, Colman, Prentis & Varley, Inc.

AVIATION DEVELOPMENTS, INC. 101
Agency—Jaycraft Company

BARBER-COLMAN CO. 60
Agency—Howard H. Monk & Assoc., Inc.

BELL AIRCRAFT CORP. 126
Agency—Comstock & Co.

BENDIX RADIO DIV., BENDIX AVIATION CORP. 70
Agency—MacManus, John & Adams, Inc.

BRIDGEPORT BRASS CO. (ALUMINUM DIV.) 58
Agency—Hazard Adv. Co., Inc.

BROOKS AND PERKINS, INC. 87
Agency—Holden, Chapin & Larue, Inc.

CANADIAN STEEL IMPROVEMENT LTD. 13
Agency—Heggie Advertising Co., Ltd.

CANADAIR, LTD. 53
Agency—Walsh Advertising Co., Ltd.

CENTURY CONTROLS CORP. 89
Agency—C. M. Johnson & Associates, Inc.

CHANDLER-EVANS CO. 8
Agency—Hugh H. Graham & Assoc., Inc.

COLOR TELEVISION, INC. 63
Agency—Sturges & Associates

CONVAIR—DIV. OF GENERAL DYNAMICS CORP. 145
Agency—Glenn Adv., Inc.

CURTISS WRIGHT CORP. 56
Agency—Burke Dowling Adams, Inc.

DOUGLAS AIRCRAFT CO., INC. 130
Agency—J. Walter Thompson Co.

DOW CHEMICAL COMPANY 92
Agency—MacManus, John & Adams, Inc.

EX-CELL-O CORPORATION 5
Agency—Holden-Chapin-Larue, Inc.

FAIRCHILD ENGINE & AIRPLANE CORP. 35, 127
Agency—Gaynor, Colman, Prentis & Varley, Inc.

FARNSWORTH ELECTRONICS CO. 83
Agency—Chamberlin-Junk Adv., Inc.

FAULTLESS CASTER CORP. 44
Agency—Perrin-Paus Co.

FENWAL, INC., AVIATION PRODUCTS DIV. 86
Agency—James Thomas Chirurg Co.

FIREYE DIV. ELECTRONICS CORP. OF AMERICA 14
Agency—Horton, Noyes Co.

GARRETT CORP., AIRESEARCH MFG. CO. 118
Agency—J. Walter Thompson Co.

GENERAL ELECTRIC COMPANY 69, 79, 84
Agency—G. M. Basford Company

GENERAL ELECTRIC CO., LMEED 106
Agency—de Garmo, Inc.

GLADDEN PRODUCTS CORP. 67
Agency—Weir Advertising

GOODYEAR TIRE & RUBBER CO., INC. 3
Agency—Kudner Agency, Inc.

GRUEN PRECISION PRODUCTS 74, 75
Agency—Grey Advertising Agency, Inc.

GRUMMAN AIRCRAFT ENGINEERING CORP. 48, 49
Agency—Fuller & Smith & Ross, Inc.

GULF OIL CORPORATION 120
Agency—Young & Rubicam, Inc.

HEWLETT PACKARD CO. 78
Agency—L. C. Cole Co., Inc.

JACK & HEINTZ, INC. 16
Agency—Fuller, Smith & Ross, Inc.

KAISER METAL PRODUCTS, INC. 61
Agency—Lincoln Ruden Adv.

KAWNEER COMPANY, THE (AIRCRAFT PRODUCTS DIV.) 82
Agency—Fuller & Smith & Ross, Inc.

KELSEY-HAYES WHEEL CO. 36
Agency—Zimmer, Keller & Calvert, Inc.

LEACH RELAY DIV. LEACH CORP. ..... Third Cover
Agency—Hixson & Jorgensen, Inc.

LEAR, INC. 9
Agency—Doyle-Dane-Bernbach, Inc.

LELAND ELECTRIC DIV. AMERICAN MACHINE & FOUNDRY 52
Agency—Fletcher D. Richards, Inc.

LEWIS ENGINEERING COMPANY, THE 101

LIBRASCOPE, INCORPORATED 18
Agency—Western Advertising Agency, Inc.

LINK AVIATION, INC. 100
Agency—Gaynor, Colman, Prentis & Varley, Inc.

LOCKHEED AIRCRAFT CORP. 110
Agency—Foote, Cone & Belding

LORD MANUFACTURING COMPANY 90
Agency—The Jayne Organization, Inc.

LYCOMING DIVISION OF AVCO MFG. CORP. 113
Agency—Benton & Bowles, Inc.

MACWHYTE COMPANY 20
Agency—Needham, Louis & Brorby, Inc.

MANNING, MAXWELL & MOORE, INC. 66
Agency—Fuller & Smith & Ross, Inc.

MARION ELECTRICAL INSTRUMENT COMPANY 81
Agency—Meissner & Culver, Inc.

MARQUARDT AIRCRAFT COMPANY 91
Agency—Heintz & Co., Inc.

MARTIN CO., THE GLENN L. 114
Agency—E. M. Halvorson Co.

MINNEAPOLIS-HONEYWELL REGULATOR CO. 119
Agency—Foote, Cone & Belding

MOOG VALVE CO., INC. 77
Agency—Warman, Robbins & Gorham, Inc.

NATIONAL AERONAUTICAL CORP. 46
Agency—Davis, Parsons & Strohmeier, Inc.

NORTH AMERICAN AVIATION, INC. 125
Agency—Batten, Barton, Durstine & Osborn, Inc.

NORTHROP AIRCRAFT, INC. 73
Agency—West-Marquis, Inc.

OLIN MATHIESON CHEMICAL CORP (EXPLOSIVE DIVISION) 7
Agency—D'Arcy Advertising Agency

ORENDA ENGINES LTD. 76
Agency—Cockfield, Brown & Co., Ltd.

PATTON MFG. CO., INC. 59
Agency—Jay H. Maish Co.

PHILCO CORPORATION 96
Agency—Hutchins Adv. Co., Inc.

RAMO-WOOLDRIDGE CORP. 89
Agency—The McCarty Company

RAYTHEON MFG. CO. 68
Agency—Donahue & Coe, Inc.

REACTION MOTORS, INC. 62
Agency—J. Wheelock Associates

RESISTOFLEX CORP. 11
Agency—Marsteler, Rickard, Gebhardt & Reed, Inc.

ROBINSON CO., RALPH C. 27
Agency—Chapin-Damm Adv.

ROHR AIRCRAFT CORP. 129
Agency—Barnes Chase Co.

ROLLS-ROYCE LTD. 17
Agency—The Wesley Associates

ROTOL LTD. 116
Agency—Gaynor, Coleman, Prentice, Varley, Inc.

ROYAL AIRCRAFT CORPORATION 85
Agency—Klau-Van Pietersom-Dunlap, Inc.

RYAN AERONAUTICAL COMPANY 15
Agency—Batten, Barton, Durstine & Osborn, Inc.

SANBORN CO. 111
Agency—Meissner & Culver, Inc.

SENSENICH CORP. 81
Agency—Foltz-Wessinger, Inc.

SERVICE STEEL DIV. VAN PELT CORP. 85
Agency—Claude E. Whipple Adv.

SERVOMECHANISMS, INC. ..... Fourth Cover
Agency—Sanger-Funnell, Inc.

SIKORSKY AIRCRAFT DIV., UNITED AIRCRAFT CORP. 94, 95
Agency—Lennen & Newell, Inc.

SOLAR AIRCRAFT COMPANY 106
Agency—The Phillips-Ramsey Co. Adv.

STACKPOLE-CARBON CO. 115
Agency—Harry P. Bridge Co.

STROMBERG-CARLSON 124
Agency—Charles L. Rumrill & Co., Inc.

STROUKOFF AIRCRAFT CORP. 98
Agency—J. Wheelock Associates

SUNDSTRAND MACHINE & TOOL CO. ..... Second Cover
Agency—Howard H. Monk & Assoc., Inc.

SYLVANIA ELECTRIC PRODUCTS, INC. 80
Agency—J. Walter Thompson Co.

TECO, INC. 87
Agency—Jaycraft Co.

TEMCO AIRCRAFT CORP. 10
Agency—McCann-Erickson, Inc.

TOMKINS & JOHNSON CO. 72
Agency—Beeson-Reichert Adv., Inc.

TOWNSEND COMPANY (CHERRY RIVET DIV.) 102, 103
Agency—Bond & Starr, Inc.

VICKERS, INC., DIV. OF SPERRY RAND CORP. 12
Agency—Witte & Burden Adv.

WEBER AIRCRAFT CORP. 4
Agency—Charles Bowes Advertising, Inc.

WESTERN AIR LINES, INC. 42
Agency—Buchanan & Company, Inc.

WESTINGHOUSE ELECTRIC CORP. 54, 55
Agency—Fuller & Smith & Ross, Inc.

WESTINGHOUSE ELECTRIC CORPORATION 112
Agency—H. W. Buddenmeier Co.

WHITTAKER GYRO, DIV. OF TELECOMPUTING CORP. 107
Agency—Mogge-Privett, Inc.

WYMAN GORDON CO. 22
Agency—John W. Odlin Co., Inc.

CLASSIFIED ADVERTISING

F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES 131-142

SPECIAL SERVICES TO THE INDUSTRY 142

PLANES—EQUIPMENT
(Used or Surplus New)
For Sale 143-144

WANTED
Planes—Equipment 144

WANTED!

Men on the Way *Up* Professionally

Check your career status for these vital factors:

Adequate income
Professional recognition
Job security
Educational facilities

Unless you can double-check every item, it will pay you to investigate CONVAIR-FORT WORTH. Get more than just "employee benefits." Work on the most advanced engineering projects with unlimited technical facilities. Enjoy life in a year-round mild climate . . . get acquainted with the friendliest neighbors on earth. Innumerable lakes and spacious parks make leisure time interesting and wonderfully relaxing. There's good living for all the family in Texas.

Particularly attractive positions are available in these fields:

Aircraft and Missile Stability and Control
Preliminary Design—Aircraft Structures
Flight Control System Design
Aerodynamic Research
Telemetering Instrumentation Design
Operations Analysis

Plus—important openings in numerous other areas of Supersonic aircraft and Nuclear Research, Development and Design.

Today, take time to investigate CONVAIR-FORT WORTH. Aircraft experience not necessary. Address confidential inquiries to:

MR. H. A. BODLEY
Engineering Personnel, Technical Employment
CONVAIR, FORT WORTH, TEXAS

YOUR FUTURE IS ***NOW*** . . .
AT CONVAIR-FORT WORTH

CONVAIR
FORT WORTH
FORT WORTH, TEXAS

A DIVISION OF GENERAL DYNAMICS CORPORATION

LETTERS

Angry Engineer

Letters to the editor published by AW and other aviation publications deploring how underpaid engineers are and what a shortage there is of them have finally forced me to express my views on the subject. As an average engineer with one of the major aircraft companies for three years I have had ample opportunity to observe my peers in action. Nine-tenths of them are overpaid for the amount and kind of work they do. A very small percentage of supervisory personnel make virtually all of the design decisions, which makes the men under them nothing but glorified draftsmen.

This condition, plus a very lax management which allows the more irresponsible employes to entice others into innumerable coffee breaks, rubber band shooting sprees and extended lunch periods so bridge and chess games can be completed, is what causes a "shortage" of engineers. There is no shortage of bodies, just of application to the job. It's the reason we're on perpetual overtime, which hurts family life and ruins weekends. There doesn't seem to be much integrity in the industry. Indeed, it could hardly be called a virtue, unless it's because so few aspire to it.

One of the more ridiculous aspects of this situation is the union of engineers (SCPEA), which nobly purports to be striving for professional status for the engineer on a par with doctors and lawyers. There is nothing in common, other than half as much higher education. The type of people represented in the union are the glorified draftsmen who don't deserve what they're given for pay. If they had any conscience at all they'd ask for pay cuts every year instead of raises. We could all live on our base salaries at a decent standard of living. It's about time we all realized that we've pushed a good thing too far. Let's give an honest day's work for our money and quit milking the American taxpayer with senseless overtime.

DOUGLAS ENGINEER

Basic Weapons

Your magazine provides stimulating reading, especially in regard to the international situation and our preparedness to meet potential enemies. The conclusion which seems apparent from this reading is twofold: (1) We are slowly losing our air superiority over the Russians, and (2) we have inadequate reserves of technical and scientific personnel. Obviously these conditions can be rectified by the expenditure of the necessary dollars to purchase more airpower and to train more engineers and scientists.

I wonder if our problems are not really more basic than this. We are engaged in a cold war where the battle is not all-out warfare yet, but a battle of words and ideas to try to win more people to our side; a battle to win men's minds. What our adversaries have to offer is Communism, a materialistic regimented state which allows no room for God. We purport to be Christian, in accordance with the teachings of Christ as given in the New Testament. Can it be that we are losing the battle of the mind because we are becoming materialistic, because we love money, ease and pleasure, because we spend more time polishing our automobiles than in worshiping God? Certainly we abhor the brutality and regimentation of Communism, but this is not enough. To win men to our side and our way of thinking, we must have something positive to offer.

I would suggest that you publish a series of articles defining "What is a Christian" and "What is a Communist?" in order to re-evaluate our position. If Christianity loses its differences with respect to Communism, then we have lost our main spring-board of resistance.

We do need more weapons and manpower, but along with this we need more men who know their God; men who have definite Christian principles and follow them, men who do not hesitate to make sacrifices of personal pride or possession for the glory of God and the protection of country.

CHARLES EUMURIAN
Senior Design Engineer
1016 West County Road B2
St. Paul 13, Minnesota

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

Pilot Shortage

Recently in one of your issues of AVIATION WEEK you pointed out that there is an ever increasing pilot shortage in the commercial flying field. Though many people feel that they understand why, I sometimes wonder if they really do.

The airlines for years have been fortunate enough to receive their pilot requirements from military outlets. Now that is no longer the case. As everyone knows the airlines are expanding rapidly and the Air Force is also growing, thus both groups have a need for trained personnel. Thus we all understand the shortage of military pilots, but what is the real solution to pilot shortage?

I think too many people are military pilot minded. It is wonderful to be able to employ someone who has been trained at someone else's expense. But let's face facts, those days may be coming to an end. What the airlines have overlooked to date is the vast number of young commercial pilots that can be found around most small airports. These are the men ages 22 to 30 who were trained under the Korean G. I. Bill.

These pilots usually can not find jobs in commercial aviation because of their lack of experience. So they are salesmen, office workers, etc. and they are forced to give up the dream of aviation for a career.

Experience and training that would bring them in reach of an airline position is too expensive and in many cases impossible, especially for a family man. The G. I. Bill for flight training, you know, is much less generous than that for college training. In fact, in most cases the G. I. Bill isn't enough to complete the commercial course alone. I believe a G. I. going to college is allowed a maximum of about $3,600, and a G. I. in flight training is allowed about $1,400. There sure is a big difference, but what happens is this: A college graduate may obtain a job in his chosen field after graduation, but a commercial pilot with only a bare, limited commercial license can't. The young pilot may need 1,000 flying hours experience, an instrument rating, and possibly a multi-engine rating.

I know personally at least twenty such young commercial pilots, who, because they are lacking the finances to go on, are left to become salesmen, office workers, etc., for life. These men all qualify in all other respects for employment in the airlines. I'm one of these men, but more fortunate. I now am a flight instructor working toward additional experience. I'm 24 years old, a veteran with a college background and 600 flying hours logged. After all how much experience and education can a man have and still be under 29 years old?

When my friends and I gather around and talk we just laugh when someone mentions that they saw an article that says there is a big pilot shortage in the airlines. After we all worked so hard for a couple of years together in order to get commercial licenses, I'm the only one in the bunch who is actually using it.

I think the aviation industry should be told about this group of young pilots who are, you might say, in the middle. There are many pilots in this group who will soon give up and will never become eligible again. If the airlines are really interested in an immediate solution to their shortage of pilots here surely is one source they could try.

J. K. CARTER
8046 Christie
Lyons, Illinois

Industry Education

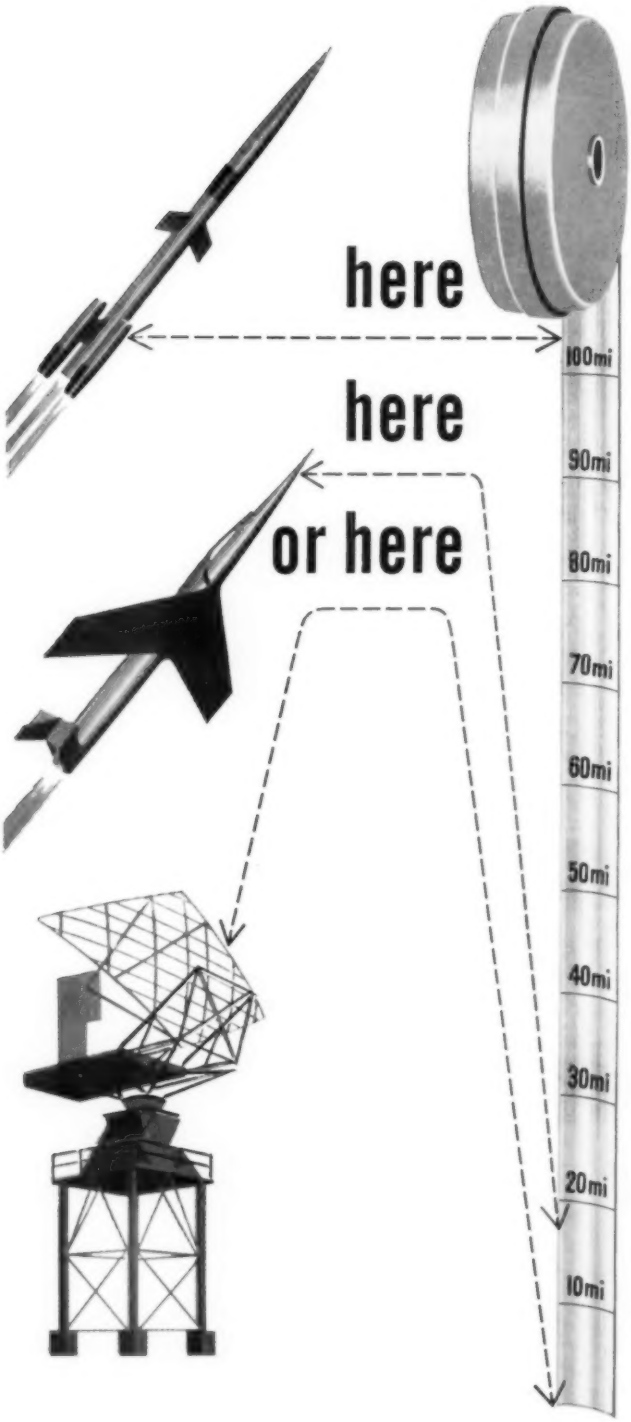
I just found a note I'd made on "Killian Outlines Technological Program For Survival" which appeared in your Jan. 30, 1956 issue (p. 26).

My suggestion is that industry promote an educational program of either the USAFI type, or night school, or part time in the plant, or some combination of these three. The company should pay for the courses and grant a bonus for completion of certain courses or the attainment of a degree.

Those taking the course for a degree should sign a contract to remain with the company for a period commensurate with the training received, say two or three years after completion.

It appears that AVIATION WEEK is acting as a clearing house for ideas on technical education so I'm sending this to you.

CDR. E. F. GALLAGHER, USN
Com Fair Jax Staff
NAS Jacksonville, Fla



...if it's dependability you want, it's LEACH you need

Electronics on the ground . . . in piloted aircraft . . . in high-flying missiles. All are tough challenges, and in all three fields one word looms above all others: RELIABILITY. That's why you find designers depending more and more on LEACH when system reliability is vital and components *must not fail.* Every unit leaving our plant . . . whether it's going to work on the ground or in the ionosphere . . . is designed, built *and tested* to deliver the performance that the job, not merely the specification, requires. Behind each unit, and ensuring its success, is design and manufacturing experience second to none.

400-cycle relays

Hermetically sealed aircraft relays

Hi-Seal modular packaged circuitry

Potted lead hermetically sealed relays

Send for the latest Leach Relay Catalog . . . your best starting point when selecting any relay.

LEACH CORPORATION / LEACH RELAY DIVISION

5915 AVALON BLVD., LOS ANGELES 3, CALIFORNIA

DISTRICT OFFICES AND REPRESENTATIVES IN PRINCIPAL CITIES OF U.S. AND CANADA

SERVOmechanisms INC.
$\frac{P_t}{P_s} = \left[\frac{(\delta+1)^{\delta+1} M^{2\delta}}{2^\delta (2\delta M^2 - \delta + 1)}\right]^{\frac{1}{\delta+1}}$
$\alpha = \frac{NW_{z_1}(M)}{SP_s} + \epsilon_c(M)$
WESTERN DIVISION
Hawthorne, California
EASTERN DIVISION
Westbury, L. I., New York
MECHATROL DIVISION
Westbury, L. I., New York
MECHAPONENTS DIVISION
El Segundo, California